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## APPLICATION OF ELECTRICITY TO TUNNELING.

The progress that has been made in recent years permits now of executing the most varied works, thanks to the transport of motive power by means of dynamo-electric machines. For the piercing of subterranean galleries in mines, in tunnels, etc., the new process is called upon to render the most eminent services and suppress those cumbersome or too primitive apparatus that we have hitherto been obliged to employ.

As regards boring, certain rocks present great difficulties, and for this reason the systems adopted differ according as the galleries are to be opened through crystalline or non-crystalline or refractory rocks. The first include quartz, granite, and limestone; the second, clay, chalk, coal, etc.; and the third, porphyry and hard rocks.

In cases where the rocks are intractable and refractory it is necessary to have recourse to explosives, and to drill blast holes, which are then charged in different ways. The others may be attacked with iron or steel tools, such as the pick and *rivelaine*.

When it becomes necessary to use powder, holes have to be drilled two to four centimeters in diameter and from 0·3 m. to 1 m. in depth, into which are introduced cartridges that are afterwards ignited by a fuse. In order to form these holes recourse is had to a steel jumper and a hammer. In measure as the work goes on the hole is filled with sand moistened with water. Finally the contents are removed with a scraper, the cavity is dried with oakum, and the cartridge is introduced and rammed down with clay. Formerly the primer was pulled out by means of a string, but as this was capable of occasioning accidents, it has for a long time been customary to employ a slow match so as to give the workmen plenty of time to get out of the way after it has been lighted. For tamping, it was formerly the practice to use a hollow tamping bar, which permitted of the passage of the fuse through it without compression. At present, operations are much simplified by the use of compressed powder, which is to be found in the market in ready-made cartridges. The quantity of powder to be used is from six to seven kilogrammes per cubic meter of quartz to be blasted.

For refractory rocks dynamite is much better, but costs more. According to circumstances, we employ three numbers of this, which differ in their composition. The first contains 75 per cent of nitro-glycerine; the second, 55 per cent, and the third, 40 per cent. We may also use gummy dynamite; which contains as much as 95 per cent of nitro-glycerine. By these means we not only obtain a fracture, but the rocks are shivered to atoms and may therefore be more quickly removed.

When it is desired to drill sloping holes rotation is substituted for percussion, and then the tool used is a sort of pipe that carries at its extremity a ring provided with steel teeth. But this process is extremely slow, and the diamond drill answers much better. This consists of a steel tube whose terminal crown is armed with teeth made of black diamond. The debris removed pass through the central aperture, and the desired result is attained much more quickly.

In drilling slanting blast holes it is necessary to measure by eye the line of least resistance in order to determine the quantity of powder to be used in cases where granitic rock is being operated upon. For lines of least resistance of 0·6 m., 0·9 m., 1·2 m., and 1·5 m., the charge should be respectively 102, 378, 906, 1,750 grammes. In sum, the charge should be approximately equal to half the cube of the line of least resistance expressed in decimeters.

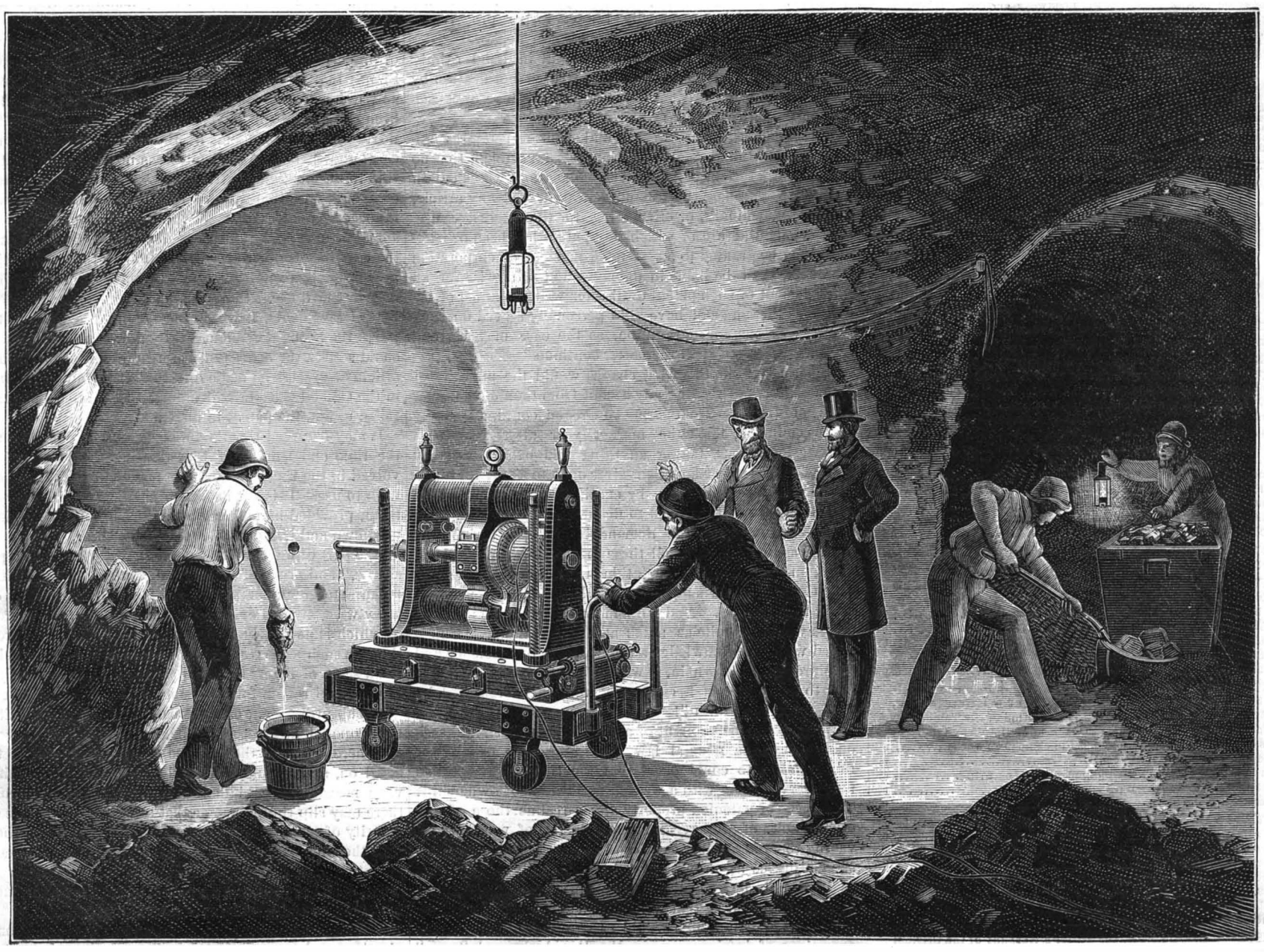
In horizontal galleries the work begins by an excavation, and above this the blast holes are drilled.

Numerous systems of rock drills have been employed, and up to the present time they have been run with compressed air. One of the principal is that of Dubois Francois, in which the rotation of the drill, instead of being continuous, is made alternating by means of a ratchet wheel and clicks. For excavating the shafts which permit of descending to the point where the subterranean galleries are to be opened, the same processes are employed, the rock being cut out in the center and blast holes being drilled all around.

Rock cutting, which is employed only in large exploitations, is performed by rock drills—apparatus which move on rails and which are provided with a revolving toothed wheel. Of these machines, which are capable of operating only in a gallery that has already been commenced, one of the principal is Winstanley's. These apparatus yield especially important results in cases where soft strata are operated upon; as for example, in such work as that of the Channel Tunnel, where the density of the material is scarcely greater than that of Stilton cheese. But machines of this kind are always cumbersome, and their starting gear quite complicated. By the use of electric processes the results obtained are more satisfactory from every point of view.

The accompanying engraving shows how a dynamo machine is employed for drilling blast holes. The apparatus is mounted upon a base provided with wheels, and, in a well conducted exploitation, these latter are placed upon rails which are laid in measure as the work progresses. The base carries four threaded uprights, which pass through the lower part of the frame, so that the machine may be firmly fixed by nuts and raised by wedges to variable heights. To the axis of the machine there may be fixed a steel drill or other boring tool, which is set in motion by the motive power from a generating machine outside of the gallery, and connected with the other by electric conductors. This is, as may be seen, a transportation of power to a short distance by means of electricity.

At the International Exhibition of Electricity, in 1881, an apparatus of this kind was shown by Mr. Taverdon. In sum, electricity now permits of doing away with apparatus run by steam or compressed air, and gives us machines that are much less cumbersome and that are consequently capable of being easily managed, a thing that is of great importance in mining operations. The use of electricity will prove very economical when the motive power can be furnished by any waterfall in the vicinity of the scene of operations, and a complete illumination of the works may be effected by means of an electric distribution furnished by the same generating machine that actuates the apparatus employed for drilling. —*La Lumiere Electrique.*



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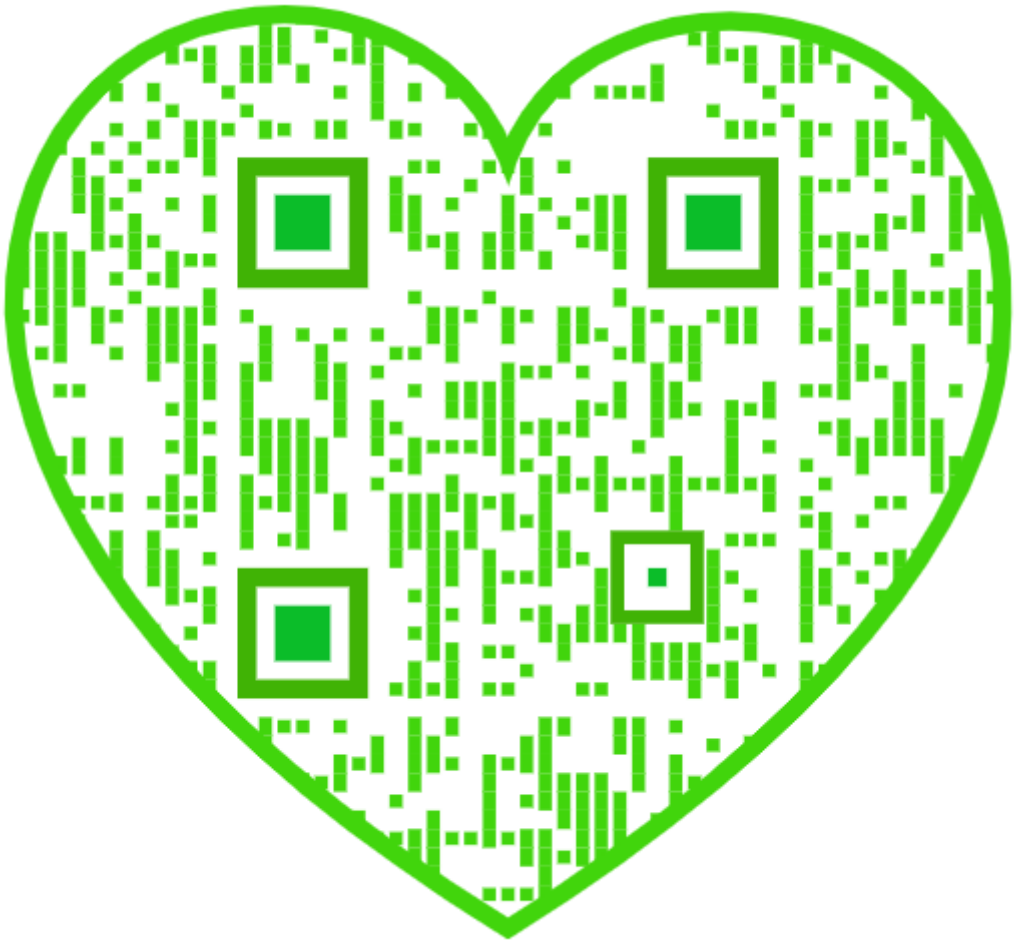

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## THE NULLIFICATION OF THE PATENT LAWS.

It is a common averment of inventors that in the absence of a reasonable hope of substantial reward, made possible by the exclusive control of their inventions as guaranteed by the patent laws, they would rarely have the will or the ability to devote to the practical development of their ideas the time and labor and money usually necessary for their realization.

Accordingly, to lessen in any way the stimulus which the law gives by protecting patentees and manufacturers under patent rights, is to strike at the very heart of the system as a means of encouraging useful inventions. If inventors cannot enjoy the fruits of their labors in this direction, they will naturally turn their thoughts into other channels, and that would be equivalent to a suspension of all progress in American arts, and our speedy decadence as a manufacturing nation. And seeing how largely our agricultural interests are bound up with and dependent upon our manufacturing interests, it is obvious that our pre-eminence in this field also would not be long sustained, if our inventors were to lessen their efforts.

There would be little need of reciting undisputed truths like these, if the urgency of private interests did not continually threaten to override public interests, and the desire to gain favor with local powers induce legislators sometimes to act without due regard for the larger interests of the nation.

Under the guise of amendments looking to the correction of real or pretended evils in the working of the patent laws, Congress is annually beset with bills that would practically nullify the most beneficent features of the patent system. Not the least dangerous of these attempts to break down the legal safeguards of the rights of patented property are those which would make a very elastic and undeterminable "good faith" a pretext for invading the rights of patentees. House Bill No. 1,081, introduced by Mr. Ray, of New York, is a fair example. Its caption is:

"A bill to provide for the protection of *bona fide* manufacturers, purchasers, venders and users of articles, machines, machinery, and other things for the exclusive use, manufacture, and sale of which a patent has been or hereafter may be granted."

Assuming that the existing laws are inadequate for the protection of the parties described, nothing would seem more fair and reasonable than the enacting of a law to that end. Unfortunately it is not that end, but the reverse which the bill in question would secure. Everything turns on what a "*bona fide*" manufacturer or user may be.

In all sincerity, the only man who can manufacture a patented article in good faith is he in whom is lawfully vested the right to manufacture it, as provided by the patent laws. Whoever has not properly acquired such right, or has not substantial reasons for believing that he has lawfully acquired it, cannot possibly proceed in good faith to manufacture an article presumedly the exclusive property of another.

In the face of this obvious truth the bill in hand calmly bases good faith on the absence of a written notification by the patentee of the existence of the patent. The first section of the bill runs thus:

"Be it enacted by the Senate and House of Representatives of the United States in Congress assembled, that no person, corporation, or joint stock association, who shall in good faith purchase, use, manufacture, or sell any article, machine, machinery, or other thing for the exclusive use, sale, or manufacture of which any patent has been or hereafter may be granted to any person, persons, or corporation whatever, shall be liable in damages and otherwise for an infringement of such patent until after written notice of the existence thereof shall have been personally served on such person, persons, or corporation, as the case may be, and such infringement shall thereafter continue."

Under a law like this what chance would the majority of patentees have of reaping any benefit from their inventions? A string of pirates from Maine to Oregon could, separately or in collusion, flood the market year after year with pirated inventions, taking anything and everything they chose, and yet never lay themselves open to a suit for damages or transgress the law by continuing to manufacture after being formally warned to desist. In a large class of profitable novelties the demand is expected to be very limited as to time; with all these the established manufacturer, on the lookout for such things and helped by the Official Gazette, could supply the trade before the inventor could turn himself. And with more serious things the patentee would be quite as much at a disadvantage. Unless gifted with fore-knowledge absolute, with omniscience and omnipresence thrown in, it would be absolutely futile for him to try to protect his property from such organized invasion "in good faith"!

What would be thought of a legislator who should seriously propose a general law exempting from penalty for robbery all who could plead that the rightful owner had never served them with a written notification of ownership? The rights of patented property are as real as those of any other species of property, and the injustice of wantonly invading them is as clear as in any other case. To legalize such injustice as proposed would be morally as atrocious as it would be constitutionally unwarrantable. Better abolish the patent system at once than take inventors' money for letters patent which would serve only to facilitate the operations of infringers upon the "exclusive privileges" nominally granted.

Scarcely less fatal to all that is valuable in the patent laws are such measures as are proposed in House Bills numbered 311 and 419. The latter provides that "hereafter in any suit brought in any court having jurisdiction in patent cases for an alleged use or infringement of any patented article, device, process, invention, or discovery, where it shall appear that the defendant in the suit purchased the same in good faith for his own personal use from the manufacturer thereof, or from a person or firm engaged in the open sale or practical application thereof, and applied the same for and to his own use, and not for sale, if the plaintiff shall recover a judgment for five dollars or less as damages, the court shall adjudge that he pay all costs of suit; and if the plaintiff shall not recover the sum of twenty dollars or over, the court shall adjudge him to pay all his own costs, unless it shall also appear that the defendant at the time of such purchase or practical application had knowledge or actual notice of the existence of such patent."

The first section of No. 311, introduced by Mr. Calkins, of Indiana, is substantially the same as the foregoing, but the second goes further and provides that at the commencement of the suit the plaintiff shall give bond to pay all costs and attorney's fees adjudged against him; and if the defendant shall finally prevail, the court shall allow costs and a sum not exceeding fifty dollars for counsel fees to the defendant. Also that a failure to give such bond shall be ground for the dismissal of the suit.

Bearing in mind the fact that a very large proportion of all patented articles are sold for less than twenty dollars, it goes without saying that a law like either of those we have cited would deprive a very large class of patentees of any hope of profit from their inventions. With such marked and positive discrimination against them in the courts, not one patentee in ten could afford to defend his rights against infringement.

Let the reader run over in his mind the all but endless list of articles of utility, convenience, comfort, and adornment, not exceeding twenty dollars in price, that go, for example, to the furnishing of his home; add those used in the construction of the house or employed in making its furniture; add the multitude of patented implements, machines, and materials used in the production and marketing of the daily food supplies of the table, by the various manufacturers of textiles, clothing, and other necessaries, conveniences, and luxuries, of less than twenty dollars cost, that help to make modern life what it is.

Review in short the entire range of the useful arts, and note how largely they produce or employ patented articles and processes that would be practically outlawed by the twenty dollar test, and then try to estimate the injury that would fall upon our productive industries in consequence of depriving such properties of the protection which the law now properly affords. Almost every industry would be impaired, and the prosperity of every manufacturing establishlishment would be endangered.

And what excuse can be given for the proposed invasion of property rights and disturbance of legitimate enterprises? Simply that misinformed, careless, or designing purchasers and users of patented articles improperly obtained have been subjected to inconvenience and loss through suits for infringement at the hands of the rightful owners. In some cases unquestioning good faith has no doubt brought hardship to unintentional infringers; but their loss is as nothing compared with that which would certainly accrue to equally innocent patentees through the operation of the proposed amendments; and the wronged patentees would not have the easy means of protecting themselves that the infringers now have by exercising due caution with regard to what they buy and use. Instead of making ignorance an excuse for infringements, it would be far more equitable to adjudge the losing defendant to pay all costs of suit unless he could satisfy the court that before purchasing or using the article or process he made diligent search and examination in the Official Gazette and among the printed patents, and failed to find the patent in question.

It may be urged that the innocent purchaser cannot afford the time and trouble of investigating the legal rights involved in the thousand and one patented inventions he may wish to use. It is not necessary that he should investigate them, provided he makes it a rule not to buy such things of unknown and irresponsible sellers. Such reasonable caution on the part of buyers would soon spoil the trade of "patent sharps," and prove of immense advantage to all legitimate manufacturers under patent rights, while practically doing away with any real evils in this connection, the correction of which is popularly demanded. To seek their correction through such measures as are now before us would simply rob a score of Peters to pay one Paul for losses which he has no good reason for incurring.

Yet absurdly, even outrageously, unjust and impolitic as the proposed measures may be, they are before Congress; and there is danger that, in the multiplicity of bills to be acted on, and through the skill with which their mischievous measures are hidden under a plausible phraseology, there may slip through some that shall grievously affect the security of patents and manufacturers' rights under them.

In the emergency it would seem highly desirable that our inventors and manufacturers should impress upon their senators and representatives in Congress the importance of the issues at stake and the need of watchfulness.

A sufficient number of well put and well directed communications and remonstrances now may prevent much mischief by and by.

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### MAGNETISM IN CITIES.

It has long been known that iron when subjected to repeated blows and shocks, while under the influence of a magnet, attains permanent magnetic qualities. Soft iron of pure quality is affected very little in this way, whereas impure wrought and cast irons are capable of being permanently magnetized to a considerable extent.

As early as the year 1600, Gilbert experimented in this direction by placing bars of iron in the magnetic meridian and striking them with a hammer. It would require very little imagination, therefore, to suppose that, in a busy city containing iron structures of all kinds, the latter should possess magnetic qualities, since they are constantly subjected to shocks and vibrations produced by traffic.

Such, indeed, is the case, and we propose to give here the results of a few experiments, made with the view of determining their character and extent. The results demonstrate anew the powerful magnetic inductive action of the earth, and show some curious facts. It may be well to remark that in what follows polarity is always designated with respect to the needle, the end pointing toward the north being called *north pole;* accordingly, therefore, the polarity of the northern hemisphere will be *south.*

The instrument used in these trials consisted of a surveyor's compass; the needle being about four inches long and delicately mounted, so that even very slight indications of magnetism were observed by it.

The first object investigated was the structure of the elevated railroads in New York city. For those not acquainted with them it might be well to explain that they consist essentially of wrought iron posts, or columns, which support trusses or open beams, upon which the tracks are laid.

Beginning with the posts, an examination of a large number of them showed that with very few exceptions they possessed magnetism, and that their *lower* extremities were *north* poles, without a single exception. The examination extended in various directions in the city, and posts distant seven miles from one another showed the same polarity. It was also observed, that while some gave very strong indications, others gave very little, but not one showed south polarity at the ground. So also did the cast iron foundation blocks show decided north polarity.

An examination of the superstructure showed that all vertical posts were more or less permanently magnetized, their *lower* extremities being *north* poles. Thus the cast iron columns which support the roofs of the stations showed this property to a remarkable degree, as did likewise a stove in the waiting room at the station. A screen of half inch iron rods showed the same property; here also the end of a gas pipe showed south polarity,

As regards the trusses which stretch from post to post, it was found that they were magnetized in such a manner, that their *lower* chords were *north* and their upper south poles. They constitute, therefore, long magnets with poles in the direction of their breadth instead of their length, as is generally the case. The same thing was observed on the trusses supporting the stations, which lie at right angles to the ones first mentioned.

This peculiarity of magnetization in the direction of the breadth of iron and steel bodies is a great deal more common than is generally supposed, and occurred in a case where it was least expected, as will be shown presently.

The writer's attention was next occupied by the Brooklyn Bridge; entering at the New York side, a few minutes' walk brought him to the cables on either side of the promenade. Selecting the most convenient parts of the cables, viz., the *tops*, or *upper sides*, and testing them, *south* polarity was shown in both of them. It was natural, therefore, to suppose that the Brooklyn ends would be north poles. Continuing our walk across the bridge and testing the cables at the center of the span, but also at the top, it was found that they still possessed the same polarity. At the Brooklyn end the cables showed the same indications. Struck by this apparent paradox, the idea immediately suggested itself that the cables were not magnetized in the direction of their lengths, but, on the contrary, in the direction of their diameters.

Testing, therefore, the bottom or under side of the cables it was found that in every instance *north polarity* was indicated; this was the case both on the New York and Brooklyn ends as well as in the middle, which leaves no doubt as to the correctness of the conclusion, that the cables are magnetized diametrically. Careful observation showed that the points of greatest intensity lay opposite each other in the line of the magnetic dip, about 76° in this locality. As regards the rest of the iron work on the bridge, it showed the same properties as that of the elevated railroads.

A further confirmation of this peculiarity was established by an examination of the rails in the yard at the Grand Central Depot, where they are subject to the frequent shocks of heavy locomotives. These rails are of steel, and show the greatest irregularities as regards their magnetic qualities, of which they are possessed more or less. Thus, for instance, some were found to be magnetized lengthwise; others, again, like the bridge cables, according to their breadth. In the latter case the top of the rail would invariably attract the north end of the needle, while the *bottom* attracted the *south* pole. The distance between these two positions being only four inches shows how marked the indications were, as the needle was completely swung around through an angle of 180°. This effect took place especially in the vicinity of switches, where connecting rods joined both rails. All rails free from contact, such as guard rails, were found to possess magnetism at their ends only.

The examination extended also to iron buildings and miscellaneous iron work in the city. Several buildings with cast iron fronts were examined, and showed that at the *ground* they were *north* poles and contrary at the top. Again, a beam in one of the warehouses now building under the arches of the Brooklyn Bridge was magnetized in the direction of its breadth. The Grand Central Depot consists of iron arches whose extremities at the ground are north poles.

The lamp posts about town showed marked magnetic properties, as did also the hydrants. All their upper extremities are south poles. In the case of the former, the neutral line was found to be on an average at about 12″ from the ground, while in the latter it was close to it, and sometimes below. In buildings heated by steam, the radiators were found to be magnetized, with *north* polarity at the *bottom.* Instances could be multiplied indefinitely, but those mentioned will suffice to show that it would be well nigh impossible to procure a piece of iron entirely free of magnetism.

The explanation of all these phenomena is very simple when we consider that the earth is a great magnet, the south pole of which is in our hemisphere. Every piece of iron and steel held vertically will therefore have north polarity induced in its lower end, which will become permanent under suitable conditions. By referring back it will be seen that this law has been uniformly followed, since all the examples given showed north polarity at their lower ends. As regards the Brooklyn Bridge cables, the explanation for their case and similar ones is to be found in the fact that they lie nearly east and west, in other words, at right angles to the magnetic meridian, consequently the direction in which they would tend to magnetize is that of their diameter.

All these investigations are what might be called qualitative, in so far as they only show the disposition of magnetism existing in the bodies mentioned. We reserve for a future article, therefore, an account of the extent of this magnetization and the exact effects upon the needle due to these and some other causes which exist in New York city.

### A BLOW AT THE INDUSTRIES OF INDIANA.

Mr. Calkins, representative from Indiana, has introduced a bill into the House of Representatives which, if it become a law, may work the most serious results upon the industries of the whole country. This bill (H. R. No. 311) provides that in cases where parties are sued for infringement of patents, the plaintiff or patentee shall pay the costs of the suit, if the damages awarded are less than twenty dollars.

The effect of such a law would be to almost completely counteract the object for which patents are issued. It must be evident that by far the larger number of patents issued are upon articles whose entire value is less than twenty dollars. In every case of a suit, therefore, the burden of costs would rest upon the patentee. He would thus find it cheaper to allow the infringement rather than prevent it; or in other words, his patent is less than worthless.

Let us see the effects of this upon Indiana alone. Her population is at present 2,000,000, and while in 1860 the number of her manufacturing establishments was estimated at 5,500, it is at present estimated at 12,000. Now by referring to the Patent Office reports of inventions it would be almost impossible to mention a single industry which is not in one way or another protected by a patent, and there have been issued to citizens of Indiana alone between 6,000 and 7,000 patents, which are still in force. The injury which Mr. Calkins would work on his own constituents might amount to large sums.

What is true in the case of Indiana holds good for the rest of the States. It is due, largely, to the influence of our patent system that our industries have attained to their present growth, and anything interfering with the former will certainly militate against the latter. "It is almost self-evident," says an able American author, "or at any rate susceptible of proof, that the magnificent material prosperity of the United States of America is directly traceable to wise patent laws and their kindly construction by the courts."

Mr. Calkins lately asked unanimous consent for immediate consideration of his bill, but objections having been raised, his motion was tabled.

In the mean time it would be well for the holders of patents in Indiana to send in written protests to their representatives in Congress, while manufacturers and inventors generally ought to use every effort to defeat such manifestly unjust and destructive enactments as H. R. number 311.

### WORKING COLD WROUGHT IRON.

Unless the iron is of small diameter, as wire, and makes a considerable circle in bending, it is usually believed that it should be heated to be worked. But if the wire is of tough iron it may be worked as closely when cold, if not as easily, as though heated. Familiar instances are the small articles known as "bright wire goods." These are staples, hooks, rings, screw eyes for picture frames, angle hooks, and many similar articles. Some of these undergo as square bending as would be possible if they were worked when red hot, as the angle hooks, which are either pointed to be driven or threaded to be screwed; the angle being perfectly square without the suggestion of a curve. These hooks are made in machine dies, and to form the elbow with a perfectly square turn the wire is actually upset cold at the bend. Other instances of the malleability of cold wrought iron are given in the heading of cut nails and iron rivets, but usually this sort of work is kept within narrow limits as to size of material. Yet a large tool making establishment in New England has built a number of heading machines on foreign orders that made conical and flat heads on bars of iron three-quarters of an inch in diameter. These heads were as clean and as free from cracks or fraying as if formed from the red hot bar, and the projection of the head on each side was slightly less than one-quarter of an inch, making a head one and a quarter inches diameter. The heading machine for such work as this must, of course, be of enormous strength to resist the blow and pressure that would upset a three-quarter inch bar to such an extent.

Wrought iron has another quality when cold—that of being welded—a quality that in some instances makes trouble, but in others is utilized. Where iron washers have been put in the step of an upright shaft carrying a heavy wheel with a view of dividing the friction, they have sometimes become welded solidly, so thoroughly united that not even heating them would separate them. Harness rings of iron wire and others for hand bags are solidly welded when cold by placing the formed ring in a die a trifle smaller in diameter than the ring, and bringing a corresponding die with great pressure on the ring, forcing the ends of the wire together.

### RESTORATION OF AMERICAN SHIPBUILDING.

An interesting and able essay on this subject, written by Mr. George B. Butler, has been issued by the Union League Club of New York.

The points which it seeks to bring forward are that this country ought to provide means and establish laws by which our ocean trade should be done in American ships. After giving an outline of the decline of our shipping, it suggests the means by which the supremacy of the United States could be re-established on the sea, as regards both merchant marine and navy. The arguments are essentially the following:

1. We should not buy foreign ships, but depend upon ourselves for whatever is necessary for support, defense, or war.

2. Foreign vessels should not be encouraged to transport our postal matter and home production.

3. That, following the example of other countries, we should resort to subsidies.

4. We must modify our navigation laws in favor of our own flag, whether subsidies are granted or not.

In addition it declares that the Naval Academy at Annapolis should be enlarged so as to include shipbuilding, both practically and theoretically, in order that not only the government, but private establishments, shall be provided with skilled minds.

### A Substitute for Transfusion of Blood.

William T. Bull, M.D., Surgeon of the Chambers Street and New York Hospitals, says the use of saline injections in Asiatic cholera in the early part of this century demonstrated the safety of such a procedure, and likewise its inefficiency in checking the career of that disease. Within a few years, however, this method has risen to the level of a life-saving measure, as a substitute for the transfusion of blood in conditions of acute anæmia and collapse. Of nineteen patients who have been subjected to the operation, when at the point of death, thirteen have entirely recovered; in three death was averted, but occurred later; and in the remainder only a temporary improvement was effected.

I have employed the solution as used by Szumann and also recommended by Schwarz, consisting of water, ʒ xxxij.; common salt, ʒ jss.; carbonate of soda, grs. xv., and in place of the irrigator a tubulated bottle with rubber tubing and canula attached, and have had distilled water at my disposal in but one case, when a two per cent salt solution was injected. The average duration of the injection has been fifteen minutes.

COLUMBIA COLLEGE has been presented, by Mr. Lewis M. Rutherfurd, one of the trustees, with a set of astronomical instruments valued at $12,000, and a further sum to cover cost of moving and setting them up. They include a 13-inch equatorial refracting telescope, with mountings and clockwork complete; a photographic correcting lens and accessories, which when in their proper place make the equatorial a photographic telescope for moon and star work; two micrometers for double-star work, and one very fine micrometer, measuring star plates, now being used by Dr. B. A. Gould, at Washington; an excellent transit, made by Stackpole Brothers; and a fine sidereal clock. Mr. Rutherfurd is an enthusiastic amateur astronomer, and has an observatory adjoining his residence in this city, which is well provided with astronomical apparatus.

TO RENDER LEATHER, PAPER, ETC., IMPERMEABLE.—M.M. Huleux and Dreyfus advise the employment of the following mixture, which operates according to the quantity and proportion of the materials added:

| | Grammes. |
|---|---|
| White or yellow wax, first quality | 1000 |
| Burgundy pitch | 60 |
| Oil of arachide | 80 |
| Sulphate of iron | 50 |
| Essence of thyme | 20 |

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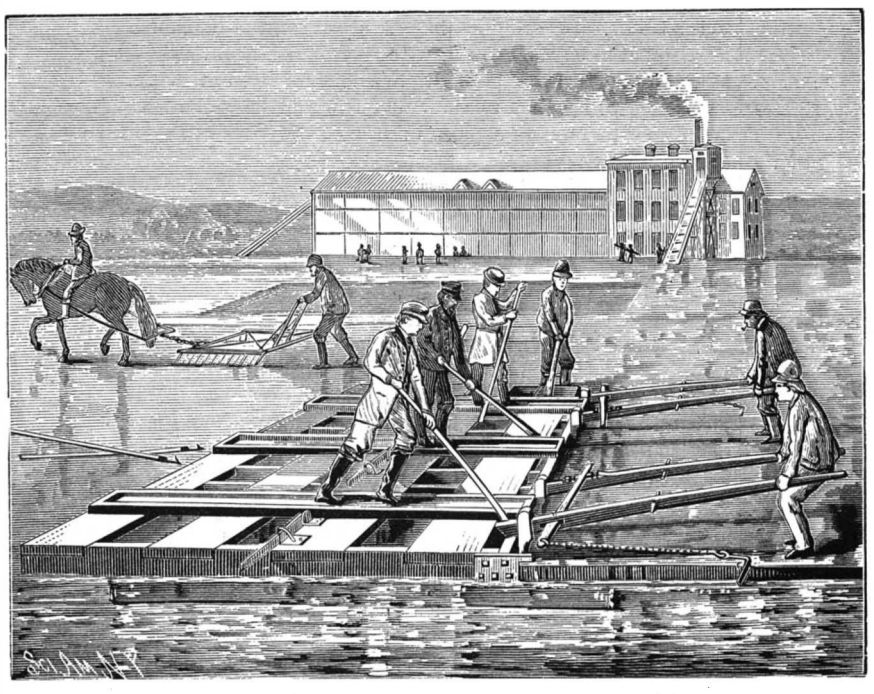
### PROCESS OF AND APPARATUS FOR BLOCKING ICE.

The accompanying engraving represents inventions relating to a process of blocking ice when it is thin by putting one or more cakes together and allowing them to freeze, thereby forming blocks sufficiently thick to house; and also to an apparatus for thus blocking. A cake of ice of convenient size (say 11 by 33 feet) is cut from the main field, and pushed down and sidewise beneath the field, being kept from moving inward too far by pins placed in holes bored in the main field the width of the cake, or 11 feet, back from the edge of the field. One or more holes are then bored through the field above the cake, and pins inserted to hold the cake in place, after which the first pins are removed. Another cake is then cut from the field and treated in the same way, the ends of the two fitting close together. Any number of cakes may be treated in this way, cut from the main field, and floated out of the way, being made fast by ropes or other means. When the tier of ice thus formed has become frozen into a solid mass, it is cut into blocks of the desired size for housing. Grooves or recesses may be formed in the cakes which are forced beneath the main field, for the purpose of allowing water to run in, which, by freezing, more perfectly cements the pieces together, so that there will be no possibility of their coming apart.



GOODELL'S APPARATUS FOR BLOCKING ICE.

The apparatus for blocking the cakes consists of a number of longitudinally placed runners, fastened together by suitable cross pieces, and having handles upon one of the long sides, as shown. The apparatus is backed on to the cake of ice, one or more persons get on it, and with suitable instruments, assisted by their weight, force down the forward edge of the cake. The apparatus is then drawn forward until projections or blocks secured to the outer runners rest upon or over the field of ice, and spikes, fastened in the blocks below the projections, engage with the vertical edge of the field ice. The projections prevent any danger of the apparatus sinking under the weight of parties on it, after the cake of ice has been moved from beneath it, and the spikes prevent any end movement of the apparatus as the parties move about. The apparatus is held in its forward position by ropes secured to the ice by suitable hooks entering holes bored to receive them. The other ends of the ropes are attached to the outer ends of levers fulcrumed to the outer handles of the apparatus, the free ends of the levers engaging with notches in the inner handles, as shown in the engraving.

When the apparatus has been thus secured the cake of ice is worked from beneath it to its place against the pins, as already described. The apparatus is then disengaged from the ice by removing the free ends of the levers from the notches, and unfastening the ropes, when it is pulled on to the field of ice and backed upon another cake. In order that the apparatus can be moved lengthwise it is provided with supplemental runners at right angles to the main runners. These runners are hung beneath and to the cross pieces by rock shafts journaled in suitable boxes and secured to the runners by rigid arms. The shafts are operated by handles held in adjustment by suitable means. The runners can be drawn up out of contact with the ice, or lowered so as to raise the main runners from the ice.

These inventions have been recently patented by Mr. George W. Goodell, of Beardstown, Ill.

### Ancient Roadways.

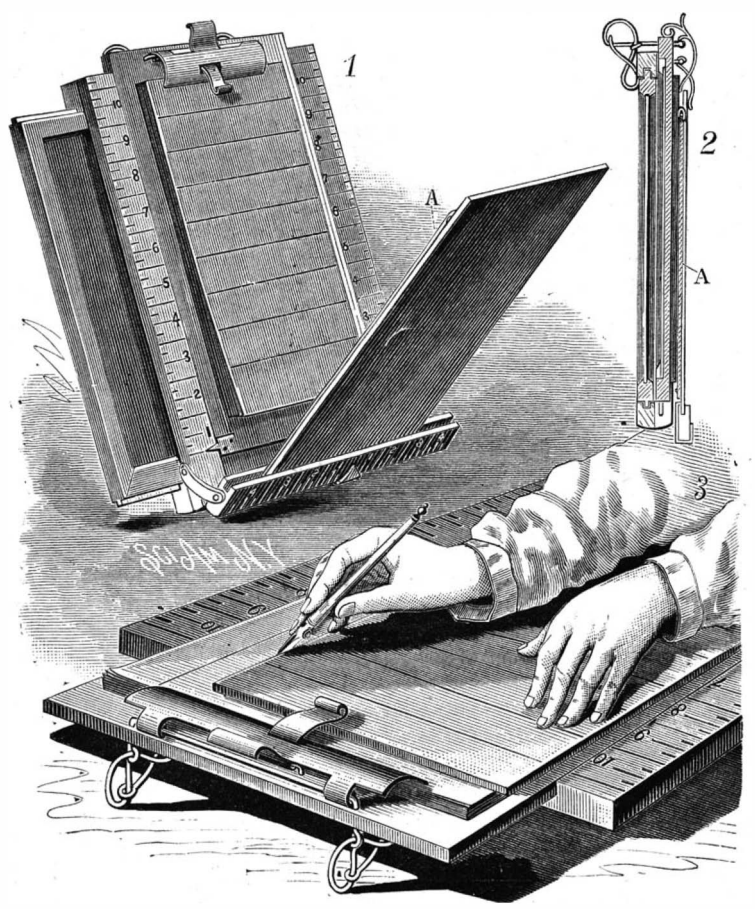
Whether in ancient times better roads and pavements were built than at present, or whether only the best ones remain, is uncertain, but it is certain that some of the remains of such structures found in Rome, for instance, evince engineering skill and perfection of work in a high degree. These were laid out carefully, excavated to solid ground, or in swampy places made solid by piles. Then the lowest course was of small sized, broken stones, none less than three or four inches in diameter; over these was a course, nine inches thick, of rubble or broken stones cemented with lime, well rammed; over this a course, six inches thick, of broken bricks and pottery, also cemented with lime; upon this was laid the *pavimentum*, or pavement, composed of slabs of the hardest stone, joined and fitted together as closely as possible. This was costly—the Appian Way, about one hundred and thirty miles in length, having almost exhausted the Roman treasury—but it was as enduring as Nature's own work. In Peru and Central America similar remains, 1,500 to 2,000 miles long, were found by the Spaniards, which, as Prescott says, were built of heavy flags of freestone, and in some parts, at least, covered with a bituminous cement which time has made harder than the stone itself. The roads of modern times lack most of the elements of durability which these possessed, and consequently wear out in a very few years. —*Kansas City Review.*

### Cost of the Great Suspension Bridge between New York and Brooklyn.

The total expenditures for this work, including interest, up to the close of the year 1883, are stated to be over twenty-one millions of dollars. Probably there is no bridge structure in the world of the same small length that has cost so enormous a sum. This is doubtless due to the peculiar ways the politicians have in New York and Brooklyn of squandering time in the execution of public works and thereby swelling the costs. The river span of the bridge is only 1,600 feet, and the two approaches combined about 3,600 feet more—approximate cost of the structure, four thousand dollars per running foot, or three hundred and thirty-three dollars per running inch.

### BLOTTER.

An invention recently patented by Messrs. L. H. Binkley and T. H. Wright consists of a device for holding writing paper, a blotting pad, and slates, the device being so arranged that it can be used for ruling the paper held in it. The board is provided at one end with a spring clip for holding the sheets of paper. A slate is held on the under side of the board.




BINKLEY & WRIGHT'S BLOTTER.

The end of the board opposite that on which is the clip is provided on each side with pintles, which pass into longitudinal grooves in the inner edges of the sides of a frame, thus adapting it to slide in and out of the frame, which is open at the upper end. Pointers, loosely mounted on the pintles, rest on the upper surfaces of the side bars of the frame, which are graduated, as shown in Figs. 1 and 3. The bottom cross piece of the frame is graduated on its upper surface, and is pivoted at its ends to links which are pivoted to the outer surfaces of the side bars at their lower ends. In the inner edge of the cross piece slides a board having a clip passing under the cross piece and forming a pointer on its upper surface. This clip prevents the removal of the board, but permits of its being moved and adjusted on the cross piece. A piece of blotting paper is held on the board by springs. A spring finger is pivoted on the upper end of the first mentioned board, and passes through a slot in the clip, so as to hold the covering board on the paper.

The construction is clearly shown in Fig. 2. A slate is held in a frame provided in its end pieces with tongues which slide in grooves in the end pieces, thus permitting the slate to slide laterally. The paper holding frame is provided at its upper end with two downwardly projecting spring legs furnished with prongs, that pass into notches in the under side of the slate frame, and hold it in place. The legs also form a support for the upper end of the board. The sheets of paper on the board can be ruled transversely by drawing a pencil along the upper edge of the blotter board, the paper board being moved out as the lines are ruled. The pointers sliding over the graduated side pieces of the frame permit of easily adjusting the board, so that the lines will be a regular distance apart.

If the sheet is to be ruled longitudinally, the blotter board is moved laterally, the pointer on the cross piece serving as a guide. If it is desired to write on the sheets the blotter board is swung down, and when the writing is to be blotted it can be swung back. If calculations are to be made while writing, the slate can be drawn out laterally. If it is not desired to write on the paper but on the slate, which is on the under side of the paper board, the blotter is swung down, the paper board is swung over it, and moved toward the upper end of the frame, when the slate is exposed. Both slates may be exposed by swinging the paper board down over the blotter. One of the sides of the frame is provided with a groove for receiving pencils, etc. In the engraving, Fig. 1 is a perspective view, showing the slate laterally extended, and the blotter board swung back from the paper. Fig. 2 is a longitudinal section, and Fig. 3 shows the device in use.

Further information concerning this useful device may be obtained by addressing the Rev. L. H. Binkley, of Bloomingburg, Ohio.

### Slovenly Reading.

The *Journal of Progress* warns all men, old and young, against an evil thing which has been described as the "prevailing pestilence of slovenly reading." This pestilence has laid low many a one who began life with excellent prospects. It is ruinous both to mind and morals. It is apt even to injure a man's business habits and prevent him from winning success in practical affairs. In time it will confound all his faculties; it will destroy his capacity for clear perception, for precise thought, and for proper reasoning. It will throw into confusion his judgment and his memory. If he does not get rid of it he can never become a good writer, or do any literary work of any kind worth looking at. How many slovenly readers are to be found in these times! They will, in their slovenly fashion, read a newspaper article, perhaps a very excellent one, and when they have got to the end of it, or, as they say, when they have "looked through it" or "glanced over it," you will find that they are unable to give any accurate account of its argument, or that they do not apprehend its fundamental points, or that they have lost one of its links, or that they have overlooked an important illustration, or that they have failed to seize a word which is the very hinge of the writer's thought, or that they have wholly misunderstood the drift and purpose of the article which they have wasted their time in glancing over. These slovenly readers are an affliction to careful and correct writers. When such a writer sees how his reasoning and his language are distorted by them, his mind is apt to become ruffled, and every one knows how a ruffled mind unfits a man for the work of perspicacious composition. We are of the opinion that the prevailing pestilence of slovenly reading is largely due to the slovenly way in which children are taught to read at school. Teachers must be very careful about this thing; they must teach their scholars to read with precision and understanding, thinking of every word, getting the sense of each sentence, and grasping the full meaning of any piece that may be before them.

MASONRY IMPERMEABLE TO ACIDS.—Construct with bricks which have been previously dipped into very thick boiling tar, then lay in a mortar made of resin and a refractory sand applied hot, and rub the joints with a hot iron.

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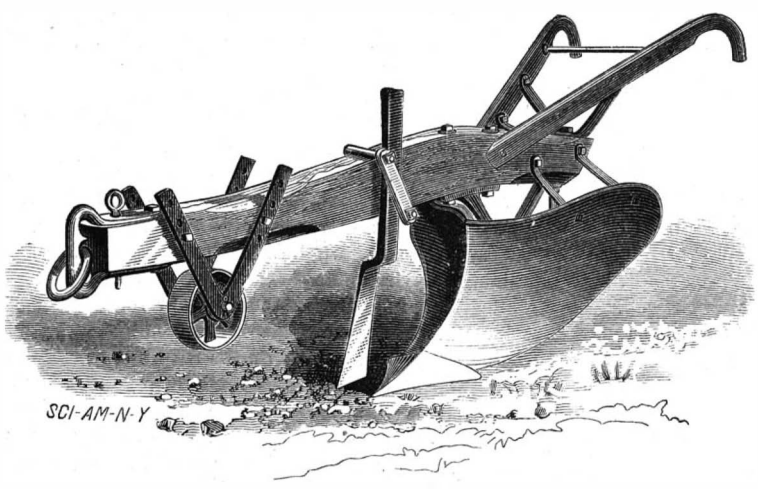
### IMPROVED DOUBLE MOULD BOARD PLOW.

Our engraving represents an improved double mould board furrowing plow, which is designed to make a furrow from twelve to sixteen inches deep in previously plowed and prepared land, for planting sugar cane. The essential feature of the plow consists in making the mould board so that all its horizontal lines from the apex to the rear end are straight instead of concave, as heretofore made. This form presents the same angle to the earth all the way from front to rear, thereby avoiding the greater angle along the rear part which causes the earth to clog on that part until it fills up the concave to a straight line, making the plow draw very hard, not only by the greater friction of earth which does slide off, but because of the great mass of earth that is pushed ahead of the plow by reason of the resistance of the mould board. The mould boards are extended higher and lower and also further back in order to prevent the earth from running over or beneath the mould board back into the furrow when plowing deeply, and also in order that the angles of the boards may be made sharper for a given width of furrow.

This plow is now being manufactured by Messrs. Dillingham & Co., of Honolulu, Hawaiian Islands, who should be addressed for further particulars.



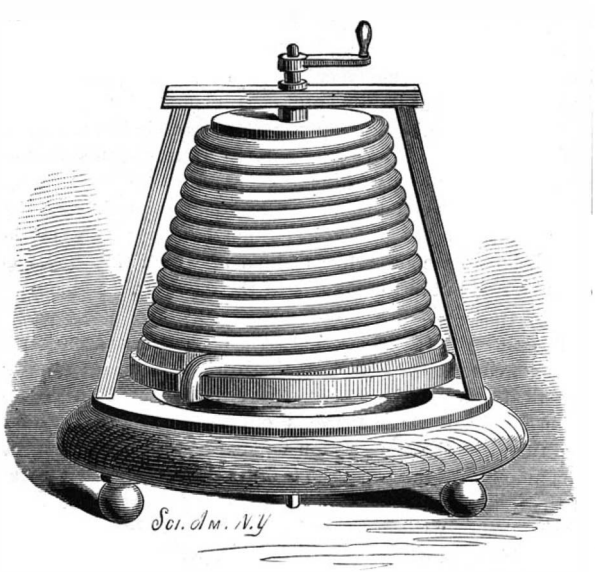

DILLINGHAM DOUBLE MOULD BOARD PLOW.

### Fruit Jellies made without Fruit.

M. Girard, director of the Paris Municipal Laboratory, says that the chemical knowledge applied to the concoction of spurious foods and drinks is of a very high order, and would suffice to make the fortunes of the adulterators a dozen times over, if applied in an honest capacity. The matter which seems to have aroused him of late is a peculiarly ingenious thing in gooseberry jelly. It appears that the article is made entirely of seaweed. The coloring matter is fuchsine, and the flavor is given by a compound of acetic ether, tartaric acid, aldehyde, and œnanthic. Inspectors often recognize it from the fact that it is "a little more elegant than the genuine article." M. Girard ought to send over to a New York grocery if he wants first class jellies of all kinds made without the real fruit.

### HOSE REEL.

The hose reel represented in the engraving is so constructed that every part of a hose wound upon it stands at an inclination in the line of its length, thereby causing the water to drain off from the interior. In the upper surface of the base, which may be supported upon legs, is a groove provided with a pipe leading down through the base. Rising from the base are uprights whose upper ends are secured by a cross piece, in the center of which and in the center of the base are journaled the gudgeons of the reel head. This reel head is made in the form of a truncated cone, and at its base is an inclined ledge having a hole through it at its thinnest part. Above the cross piece the upper gudgeon is provided with a crank by which the head may be revolved for reeling up the hose. In reeling, one end of the hose is first passed through the hole in the ledge when the crank is turned, so that the first coil of hose rests upon the inclined ledge. The next coil, coming upon the first, which is held at an inclination by the ledge, will also take the same inclination and will furnish an inclined support for the next coil, and so on. By this arrangement all the water in the hose




BILLINGS' HOSE REEL.

will run into the groove in the base and be conducted away by the pipe. At the upper end of the reel head is a hook for holding the upper end of the hose. By the use of this device the interior of the hose is quickly relieved of water and kept dry without any extra trouble or attention.

This invention has been patented by Mr. Albert Billings, of Bergen Point, N. J.

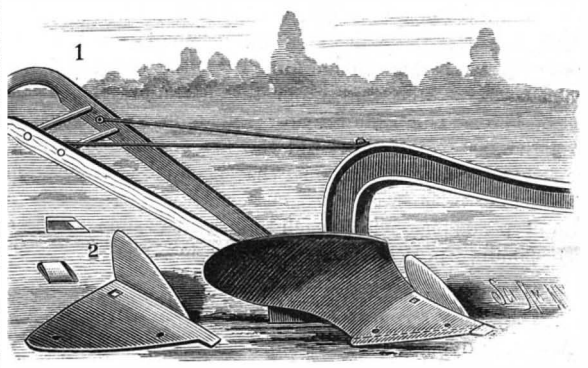
A PROCESS FOR FROSTING GLASS.—To give glass this appearance, it is only necessary to coat it with the following composition: Sulphate of magnesia diluted in beer, with a little dextrine added.

### Poisonous Action of Metals upon the Microbia.

To obtain the microbia the author used sea water in which a small quantity of peptone had been dissolved. This liquid rapidly swarms with microbia. He found the metals fatal to microbia in the following order: Mercury, zinc, cadmium, copper, nickel, iron (ferric salts), barium, lithium, magnesium manganese, ammonium, calcium, sodium, and potassium. The poisonous dose for bacteria is in general about twenty times greater than for fishes. The author points out the extremely poisonous character of ammonium and potassium for fishes, while toward microbia they are comparatively inert.—*Ch. Richet.*

### PLOW.

An invention recently patented by Mr. Adam C. West relates to the point of a plow, including the colter and share thereof, and is designed as an appendage or sheathing to the




WEST'S PLOW.

cast iron point of a plow, for the purpose of giving thereto good, durable steel edges, which may be sharpened as required. The point of an ordinary cast iron plow, either new or worn out, is covered with an attachment, to give it increased strength, durability, and ease in the performance of its work, which can be applied by a blacksmith of ordinary skill at a comparatively small cost.

A steel covering plate is cut and bent to form the share and colter (shown detached in Fig. 2), which may be of any desired shape. The share is made to project over the right hand wing of the point about one and a half inches, or sufficiently to give a good, lasting steel cutting edge that may be sharpened if necessary. The whole may be made from a mainly triangular shaped plate, except the forward lip end, which lies under the detachable cap point (shown at the left of Fig. 2), the left hand portion of the plate being bent up to form the colter, the front edge of which is sharpened. The plate is secured to the cast iron point by the same bolt that holds the cast point to the plow, the bolt first passing through the steel plate, having a countersunk hole in it for the purpose, and by any number of rivets passing through both the steel plate and cast point, the heads being countersunk. The cap point is fitted over the lip end of the plate and the forward end of the point. It is formed of a steel plate cut into suitable shape, and bent around and welded to form a hood or sheath to the forward end of the point, and having a piece of steel welded in it at its front end, sufficiently large to permit of its being sharpened occasionally. The solid point of the cap is hardened to give it durability. The cap is fitted over the plow point by heating it and driving it on.

Further particulars concerning this useful device may be obtained by addressing Mr. Charles V. West, of Blanchard, Mich.

### Attraction and Repulsion of Bodies in Motion.

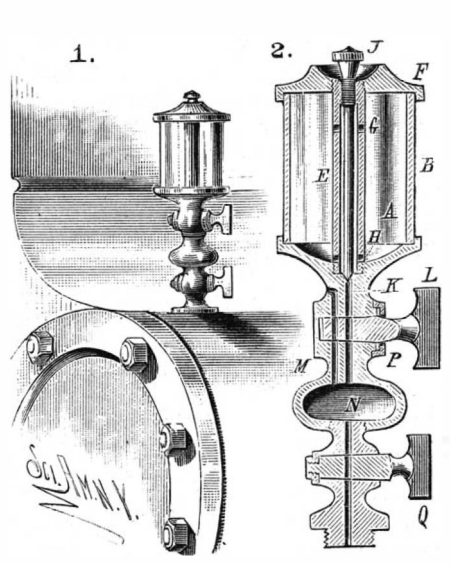
DR. MONKMAN.—The attraction of a light balanced body to a vibrating tuning fork was shown; also the attraction between two disks of paper revolving parallel and in the same direction. The author showed that two smoke rings traveling abreast in the same direction attracted each other, and that two paper rings revolving in the same direction close together attract, while if revolving in the other direction they repel.

### Transmission of Power.

Will electricity enable us to transmit power in large quantities more efficiently than other means? Will it enable us to transmit small quantities? These questions were put to the Society of Arts, and answered by Professor Osborne Reynolds in his Cantor lectures as follows: Thanks to the experiments of M. Deprez, we can say that a current of electricity, equivalent to 5 horse power, may be sent along a telegraph wire one-sixth inch in diameter, some ten miles long—there and back—with an expenditure of 29 per cent of the power, because this has already been done. Compared with wire rope, this means falls short in actual efficiency, as Messrs. Hems send 500 horse power along a ¾-inch rope. To carry this amount, as in the experiment of Deprez, 100 telegraph wires would be required; these wound into a rope would make it more than 1·4 inches in diameter, four times the weight of Mr. Hems' rope. With the moving rope the loss per mile is only 1·4 per cent, while with the electricity it was nearly 6 per cent; so that, as regards weight of conductor and efficiency, the electric transmission is inferior to the flying rope. Nor is this all. With the flying belt, Mr. Hems found the loss at the ends, in getting the power into and out of the rope, 2½ per cent; whereas, in M. Deprez's experiments, 30 per cent was lost in the electric machinery alone, which is very small as such machinery goes. But this is not all. No account is here taken of the loss of power in transmission to and from the electric machinery. Taking the whole result, it does not appear that more than 15 or 20 per cent of the work done by the steam engine could have been applied to any mechanical operation at the other end of the line, as against 90 per cent which might have been realized with wire rope transmission.

### ENGINE LUBRICATOR.

The lubricator herewith illustrated is designed for the cylinders of steam engines. The hollow stem, K, has a circular flange for supporting the glass cylinder, B, which forms the sides of the oil reservoir. The tube, E, forming a continuation of the stem, passes through the cylinder, and has a cap, F, screwed on its upper end for closing the upper end of the cylinder. The flange forms a concave bottom for the cylinder, and the tube is provided with perforations, G, near its upper end, and also with others, H, at the bottom of the cylinder, for the passage of air and oil, respectively, in filling and draining the cylinder. The upper end of the tube is closed by a valve stem, which is made smaller for the most part of the bore of the tube, and its lower end is made conical to adapt it to close the upper end of the bore, K, in the stem, while its upper end is made large enough to close the upper end of the tube into which it screws. In the stem just below the oil reservoir is a two-way plug, L, having one way turned into alignment with the bore, K, in the stem, and the other way aligning with the bore, M, which is formed in the stem parallel with the bore, K, and leading from the interior of the oiling chamber, N, to the outer air. The plug, L, is made slightly tapering, with a reduced portion at its outer end which carries an annular packing nut, P, screwing on a boss of the stem. The oiling chamber is formed in the body of the stem, and is closed from the steam cylinder, into which the stem is to be inserted, by a second plug, Q, having a single way aligning with the bore, K, when turned to proper position. The reservoir is filled with oil through




HORN'S ENGINE LUBRICATOR.

the tube, E, the plug, L, being closed and the plug, Q, opened. When filled the valve stem is returned to position, the lower plug is closed, and the upper plug opened. Then by lifting the valve stem a given quantity of oil is allowed to descend into the chamber, N, forcing the steam therein out through the bore, M. The quantity of oil allowed to descend from the reservoir is gauged by a graduated scale on the glass cylinder. After the desired quantity has descended, the upper plug is closed and the lower one opened to allow the oil to pass into the steam cylinder.

This invention has been patented by Mr. William J. Horn, of 606 West 12th Street, Chicago, Ill.

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### Chlorozone.

When chloride of lime, or bleaching powder, is decomposed with cold hydrochloric acid, and the chlorine thus liberated and mixed with air is passed into a solution of caustic soda, it is absorbed and forms a liquid of unknown chemical composition. The liquid possesses bleaching and decolorizing properties. De Dienheim-Brochowski, of Paris, was the first to prepare this liquid, and to it he gave the name of "chlorozone."

Prof. Mill has recently proved, says the *Farberei-Muster Zeitung*, that this substance is not identical with the well known bleaching salt called hypochlorite of soda, and which one would naturally expect to have formed by this reaction. In fact, it differs from the latter in color, odor, and its more energetic bleaching power.

Chlorozone forms a clear liquid having a specific gravity of 1·27, is of a yellow color, and possesses a characteristic odor. When kept in glass carboys, in a cool, dark place, even if very concentrated, it keeps quite well, decomposing but slowly and giving off oxygen. More dilute solutions—"chlorozone water"—are more permanent.

Its remarkable bleaching power is increased by sunlight or the addition of acids and bromine. In bleacheries, dilute solutions, having a gravity of 1·07 to 1·03, are employed. Both this and the concentrated solutions of chlorozone are commercial articles.

When chlorozone is used for bleaching purposes, the tanks in which the operation is conducted must be lined with pitch or asphalt; wood weakens its action, because it is itself attacked, and vats made of sandstone are liable to cause iron stains. The bleaching follows directly after the alkaline bath, first in the cold, then at a temperature of 120° to 140° Fahr. The wringing, acidifying, and rinsing are the same as in the ordinary process of quick bleaching.

Chlorozone is well suited to replace chloride of lime for bleaching cotton, flax, linen, jute, and hemp, but is not adapted to silk and wool. In very dilute solutions of 1 to 400 it is recommended as a substitute for chloride of lime in the household and for public laundries, being easier to manage and less dangerous, although more efficient. When dilute, as 1 to 39, it removed old stains of red wine in half an hour.

It may also be stated that chlorozone is a powerful disinfectant.—*Deut. Industrie Zeitung.*

### Coloring Soft Solder Yellow.

When brass is soldered with soft solder, the difference in color is so marked as to direct attention to the spot mended. The following method of coloring soft solder is given by the *Metallarbeiter:* First prepare a saturated solution of sulphate of copper (bluestone) in water, and apply some of this on the end of a stick to the solder. On touching it with a steel or iron wire it becomes coppered, and by repeating the experiment the deposit of copper may be made thicker and darker. To give the solder a yellower color, mix one part of a saturated solution of sulphate of zinc with two of sulphate of copper, apply this to the coppered spot, and rub it with a zinc rod. The color can be still further improved by applying gilt powder and polishing.

On gold jewelry or colored gold, the solder is first coppered as above, then a thin coat of gum or isinglass solution is applied and bronze powder dusted over it, which can be polished after the gum is dry and made very smooth and brilliant; or the article may be electro-plated with gold, and then it will all have the same color.

On silverware the coppered spots of solder are rubbed with silvering powder, or polished with the brush and then carefully scratched with the scratch brush, then finally polished.—*Deut. Ind. Zeitung.*

### Electric Lighting in Europe.

Frederick A. Gower, the well-known telephone inventor, was eight years ago a journalist at a small salary in Providence, R. I. Last year his telephone interest in England alone was sold for $700,000 in cash. "Electric lighting in Europe," Mr. Gower informs the New York *Tribune*, "is advancing more rapidly than the American public seem to realize. Gas is usually far poorer in quality than here, and modern improvements in making it are slowly adopted. It is rarely used in bedrooms and almost never in parlors of good houses. And when it is used, the law, in Paris for example, requires the pipes to be accessible, which means being in sight and a blemish in a finely decorated room. You can imagine the pleasure given by a good incandescent light, under such conditions. It is much the same in industrial establishments. The Bon Marche, at Paris, where 1,500 clerks are employed, tried 400 electric lamps, and has now increased the order to 2,000. The St. Lazare railway station tried a few lamps in the vestibule, and will now extend the system to the whole vast establishment, covering some twelve to fifteen acres. The Grand Opera House at Paris, with its 1,100 permanent employes, has a gas bill of $60,000 a year, and it has been experimenting, for the last two years, with almost every known system of electric lighting, American or otherwise. The result has finally been in favor of the Edison system, and I learned in Paris lately that the contract with that company had been concluded. A rather curious result goes with this one. The Director of Public Works in Paris has said that whoever won the Opera would stand first for the concession for that great central lighting station in Paris which will be one of the marvels of Europe, a few years from now. In Milan, the Manzoni Theater is lighted by electricity, and the vast theater, La Scala, now has a complete equipment of engines, boilers, and dynamo machines from New York, adequate to 10,000 lamps, in position under the shadow of the great cathedral, without so much as a wire or a puff of steam in sight from the cathedral itself. Wires in the air, as we have them here, would not be tolerated in any city on the Continent. Several systems to avoid this danger, as well as the terrible disfigurement of the streets, are in use abroad. In Paris there are, of course, the sewers. In other localities, pipes are laid near the curbing, with openings at intervals of 1,000 feet or so, through which the wires can be pulled as required, and occasionally a case occurs where the wires are laid in leaden tubes roughly buried in trenches. A few cities, like Antwerp and Brussels, where central station systems are in hand, have allowed the wires in the air, as an experiment to show the workings of the system, and also in cities like Amsterdam and Venice, where the 'streets' are so moist that digging is unhealthy. Generally speaking, a European architect, who usually has charge of a building as long as it stands, hates the sight of a wire on a roof, and prevents it if he can. The architect thus in charge of the Louvre refused to allow an experimental wire to cross that half mile of splendor, even to oblige the Government of the Republic—and I think he was right. The Americans are lighting the House of Commons, though the awarding of the contract to them was opposed in the House by a young sprig of the more recent aristocracy, who indulged in some vulgar twaddle about 'encouraging Yankee adventurers.'"

### Fire Protection in New York.

Between Broadway and West Broadway, Canal and Duane Streets, this city, is contained merchandise of a greater value than in any other section of like size in the country. This district has no adequate water supply, the pressure in the mains being too low to be of much use against a fire of any magnitude. To partially relieve this condition of affairs the fire commissioners have adopted a plan which provides for two movable tanks, 18 feet in length and 6 feet in width and depth, to be mounted on wheels and drawn about as required by horses. Water from the North River is to be forced by the fireboats through 3¼ inch hose into one end of these tanks, and pumped out at the side by fire engines. Each tank will hold 4,000 gallons, and will afford work for three fire engines. No point in the dry goods district is more than a mile from the river, and the fireboats have often sent water through more than 1,200 feet of hose. The boats are now relied on to force water through 4,000 feet of hose, and the fire engines to carry it the rest of the mile. The somewhat peculiar configuration of New York, being simply a long, narrow tongue of land with deep tide channels on each side, renders such, or some corresponding project, extremely feasible.

### A New Process for Making Dynamite.

Although dynamite is less dangerous to handle than nitroglycerine, its preparation, involving as it does the nitration of the glycerine, is not less easy nor is it safer. When the glycerine enters the mixture of nitric and sulphuric acid, the reaction takes place with such violence as to produce a large amount of heat.

According to the *Polytechnisches Notizblatt*, a much safer method is now in use by Boutmy & Faucher in their powder works. Here the operation of nitrating takes place in two stages. The glycerine is first converted into a sulphoacid by the action of strong sulphuric acid. An acid mixture is prepared separately from equal parts of nitric and sulphuric acid. The two liquids are then mixed. The sulpho-nitric acid absorbs nearly as much heat in liberating the glycerine from its combination as is formed by its combining with the glycerine; hence, it acts as a refrigerant to keep it cool, and the process is not attended with much increase of temperature.

In the new process the nitro-glycerine is not formed so suddenly as in the old way, but slowly and steadily, settles rapidly, and can be easily washed, while the yield, it is claimed, is greater. Nevertheless, Boutmy & Faucher have taken every precaution to avoid explosions and to protect the workmen from fumes.

### What the Colors of Buoys Mean.

"When you enter any harbor in the world," said a pilot to a *Sun* reporter, "where the channel is marked by buoys, you will find that those on your right as you pass in are painted red, and those on your left black. If you should see one painted in red and black horizontal bands, the ship should run as close to it as possible, because that indicates the center of a narrow channel. Buoys with red and black vertical stripes always mark the ends of spits and the outer and inner ends of extensive reefs, where there is a channel on each side. When red and black checkers are painted on a buoy, it marks either a rock in the open sea or an obstruction in the harbor of small extent with a channel all around. If there are two such obstructions and a channel between them, the buoy on the right of you will have red and white checkers, and the one on your left will have black and white checkers. When a wreck obstructs the channel a green buoy will be placed on the sea side of the wreck, with the word 'wreck' plainly painted on it in white letters, provided there is a clear channel all around it; otherwise, an even number will be painted in white above the word 'wreck' when the buoy is on the right side of the channel, and an odd number if the buoy is on the left."

### Composite Pavements.

An experimental length of composite pavement of a novel character is, says *Engineering*, now being laid in Cannon Street, opposite the Mansion House Station of the Metropolitan District Railway. It was devised several years ago by Mr. H. F. Williams, a well known engineer and contractor of San Francisco, and in several of the principal streets of that city the pavement has been subjected during the past seven years to the test of traffic at least as heavy as that of Cannon Street. The fact that after this prolonged and severe trial it remains to-day, except for a slight wear of the surface, in as good condition as when it was laid down, is sufficient proof that the system possesses such excellent qualities of resistance to wear as to render a fair trial of it advisable for the metropolis.

The mode of construction of this pavement is very quickly described. A thoroughly good concrete foundation is necessary, faced with cement which must be set hard and quite dry before the superstructure is laid on. This consists of wooden blocks about 8 inches long by 4 inches deep by 1½ inches wide, which are set upon the foundation like bricks on edge, and with the end of the grain—that is, with the 1½ inch side—uppermost. Previously to being thus set, each block is dipped to half its depth in a boiling mixture of Val de Travers asphalt and Trinidad bitumen. Thus coated the blocks are laid side by side so as to break joint, and as close together as the coating of asphalt will allow, the covering insuring a space being left between the blocks of about one-eighth inch all round, while at the same time it cements them firm to the foundation.

The spaces are afterward filled up with boiling asphalt so thoroughly as to hermetically seal up each block, and cement it to the adjacent ones; in this way a perfectly homogeneous covering is laid over, and cemented to, the foundation. Upon this covering is then spread a coating of asphalt about half an inch in thickness mixed with coarse sand or grit; the coating must essentially be of a different character to the material used for inclosing the blocks, since it has to resist the wear of the traffic, and not to take the simply passive part of the latter. At the same time the surface covering is not so hard as that of the ordinary asphalt paving, but while thoroughly able to resist any deformation from passing loads or alteration in structure from heat, the mixture employed has sufficient elasticity and grip to make it free of the greatest drawback and most serious evil of asphalt pavement—its slipperiness when humid.

This important advantage is secured partly by the blending of different kinds of asphalt, but chiefly from the existence of the elastic cushion of cemented wood interposed between the covering and foundation. Properly laid the pavement is, as long experience has shown, an admirable one, but evidently its success or failure depends, probably more than that of any other system, upon the care with which it is laid down. The absolutely essential conditions for success are, besides the proper selection of materials, a hard, regular, and dry foundation; a thorough cementation of the wood blocks to this foundation; the thoroughly complete incasing of the blocks with the asphalt glue, and the efficiency of the latter in making the whole structure homogeneous throughout; the use of very small gravel or coarse sand properly mixed with the harder asphalt, which forms the wearing surface.

It is evident that to secure all these conditions essential to success, considerable skill is necessary to lay the pavement, and especially everything must be kept quite dry, and the asphalt applied as hot and liquid as possible. Without these precautions being taken, the pavement, which is of comparatively slight proportions, must inevitably fail under the stress of incessant and heavy traffic. We point out these facts because the Williams pavement in San Francisco has proved itself to be all that its inventor has claimed for it, and because in our opinion the Cannon Street sample has not been laid under the conditions necessary to secure the success that may fairly be anticipated. Should experience show that we are right in this conclusion, the failure ought to be ascribed not to defect in the principle, which has been fully established, but to the imperfect manner in which the work has been carried out in the absence of the inventor.

THE Bureau of Education at Washington has recently received a communication from the Royal Institute of Higher Practical Studies of Florence, Italy, stating that the competition for the Bufalini Prize is open to all nations and that the time for the competition will close on October 31, 1884. The amount of the prize is 5,000 lira=$965, and the subject of the thesis is the experimental method in science. The thesis must be written either in Italian or Latin. This will be the first competition for this prize, which is designed by the will of the founder to take place every twenty years. The object of the competition is to show the superiority of the experimental over the *a priori* method of reasoning, and to give a short history of the progress of experimental science since the bestowal of the last prize.

### Improvement of Galveston Harbor.

Galveston is throwing up her hat in honor of Capt. Eads' answer to her committee's letter relating to her bar. The Captain says that if Congress will give him $7,500,000 he will guarantee 30 feet of water, and maintain that depth for twenty years at a cost of less than $100,000 a year. He proposes to give the city 22 feet of water within two years. A Texas newspaper says that with 30 feet of water on her bar Galveston will soon rank New York city.

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### New Discoveries of Cave and Cliff Cities.

Mr. James Stevenson, of the Geological Survey, has reported to Major Powell, as one of the results of his last season's field operations, the discovery of several more ruined cave and cliff cities, differing in some respects from any he had before examined. The most remarkable was a village of sixty-five underground dwellings, situated near the summit of one of the volcanic foothills of the San Francisco Mountains, in the San Juan region of Arizona. The surface stratum of the hill had by exposure become hardened, and formed the common roof for the entire community. The dwellings were excavated after a common pattern, and a description of one gives an idea of the whole. They had no intercommunication beneath the surface, and were only accessible by means of square holes leading from the surface by a vertical shaft to the floor of the main room of the dwelling. Foot rests—holes at convenient distances along the sides of the shaft—served the purposes of a stairway.

Descending the shaft the explorers found themselves at the side of an oval shaped, arched roofed room, about twenty feet in its smallest diameter. At the ends and on the side opposite the entrance low doorways connected the main room with smaller rooms, the whole suit, or dwelling, consisting of four apartments. One of the smaller rooms had its floor excavated to a depth of two or three feet below those of the other rooms, and is supposed to have served the purpose of a storeroom or cellar for the ancient occupant. The other small rooms may have been bedrooms.

A groove eighteen inches deep by fifteen in width, extending from the floor of the main room up one side of the shaft to the surface of the hill, its bottom filled with ashes and its sides blackened by smoke, formed the fireplace and chimney of the establishment. Around the mouth of the shaft a stone wall was found, forming by its inclosure a kind of door yard to the dwelling below. The wall doubtless served the double purpose of guarding against snow slides, which might otherwise fill up the rooms and bury the occupants, and against the accidental fall of an inhabitant into his own or his neighbor's dwelling, upsetting the dinner pot, and possibly breaking his neck in the operation.

Considerable debris was found in these ancient dwellings, an examination of which led to the discovery of many curios illustrating some of the social and domestic customs of the extinct race. Stone mauls and axes, the implements used in excavating the dwellings; pottery bearing a great variety of ornamentation; bone awls and needles of delicate workmanship; the metate or family grinding stone for grain, its well worn surface indicating long use; shell and obsidian ornaments and implements of wood, the uses of which were undiscoverable, were among the trophies of the exploration.

Search was made for a watercourse or spring, but no appearance of the existence of water in the neighborhood during recent centuries was discovered. There were signs of intercommunication between this village and a cliff city some fifteen miles distant—also a new discovery—which indicated the contemporaneous inhabitancy of the two. This city, or rather cluster of villages, occupied the sides of a cañon which has recently been christened Walnut Cañon. It is an immense fissure in the earth, with nothing above the general level of the country to indicate its existence to the traveler until he stands upon the sides of its almost precipitous brink. The sides have been gullied by storms and torrents, leaving shallow, cave-like places of great length at different heights, along the bottom of which, whenever the ledge furnishes a sufficient area, dwellings in groups or singly were built.

The group or village which was most narrowly examined was about three-quarters of a mile in length, and consisted of a single row of houses, the common rear wall being the lining rock, while the sides and fronts were made of large squared stones laid in clay. A narrow street or pathway leads along the entire front. Other and similar villages could be seen along the cañon for a distance of five miles. Among the relics found here was a wooden spindle whirl, similar to those in use by the Pueblos of the present time, but unlike them in the apparent manner of its manufacture. Nothing indicating the use of metallic tools of any description was discovered. The surface of the wood of which the whirl was formed had apparently been charred and then ground down to the required size and shape by rubbing it upon sandstone. A shaft of reed similar to bamboo, a species entirely unknown in that region at this time, still remained in the whirl. It had been broken by the ancient workman and neatly mended by winding about it a piece of fine twine. The ends of this twine being examined under the microscope disclosed the fact that its fiber was of very fine human hair.

Articles of wood, corncobs, and even the perfect grains of corn; walnuts, bones of elk, antelope, and wolf; portions of wearing apparel of a fabric resembling the mummy cloth of Egypt, but made from material unfamiliar to the explorers, and other perishable articles were found in abundance buried in the piles of debris which partially filled these deserted homes, and would at first thought seem to indicate somewhat recent inhabitancy. On the other hand, however, the preservative qualities of the atmosphere of this region are remarkable, and it is the belief of the explorers that centuries have elapsed since the last of the departed race or races occupied these old cities and villages as homes.

The absence of weapons of war, of works of defence, other than such as are constituted by the selection of almost inaccessible localities, of temples or idols, of hieroglyphics or pictures, together with the durability and solidity of the dwellings, so different from anything to be found of the handiwork of existing uncivilized races of that region, and the wide extent of these ruins, which indicate the existence of allied races, covering large portions of the present territories of Arizona, New Mexico, and Utah, as well as Northern Mexico, are the elements of the problems involved in the origin, history, and disappearance of these races—problems which seem no nearer solution than when Colorado, nearly four hundred years ago, made a raid for the purposes of conquest among these places, and through his priests gave to the world the first meager accounts of them—then as now vacant and ruined.

### Affairs at the Patent Office.

WASHINGTON, D. C., January 7.

Although the Patent Office deals in dry, hard facts, and the applicant for a patent and the examiner who investigates his claim have generally no more humor in them than a graven image, there are many things that have a humorous side to them even here. In looking over the list of applications the other day, I made some curious discoveries which I think worthy of mention. Marc Antony wanted a patent for a fruit can; T. Allwood for a barrel platform; D. T. Apple had applied his ingenuity to the construction of a pie baker; W. B. Argue appeared as an attorney of record for a claimant, and J. Broom got a patent for a refuse ejector. O. Bottles had discovered a new beer faucet, and S. A. Beer had invented a distillery worm. E. Buss wanted a patent for a gas engine; J. Bumhill for a planter; H. Boot for a shoe horn; A. Christ for a torpedo; Crofut & Knapp for felt hats; Car Carpenter for a car heater; L. Cutshawl for a churn; A. J. Dine for an earth auger; and a gentleman rejoicing in the extended name of Ludovic Charles Adrien Joseph Guyot D'Arlincourt applied for a patent for an improved magnet.

One Preserved Fish wanted a patent for a mast for vessels; while Lazarus Fried had turned his attention to toy watches. F. F. Foot very properly had turned his inventive genius to boots and shoes, and O. Faucet had looked after drain pipes. H. Goodenough wanted a patent for a horse shoe; M. Glasscock for a plow; J. S. Gold for a show case; I. Glassblower for a draught equalizer, and C. J. Glover, of Gloversville, N. Y., for a glove fastener. C. X. Harmony had invented an improved cornet mouthpiece; T. January a fluting machine; E. Kiss an omnibus pole; and C. Lightsinger a harmonica. W. Legg was made happy by a patent for a boot upper; A. North has one for a refrigerator; E. B. Meatyard one for a butcher's saw; Modest Merke for a fly trap; F. Million for a gas engine; Mustapha Mustapha, of Zagazig, Egypt, for a cotton gin; and Rob Roy McGregor for a milk can. Every one knows that W. D. Puffer has patents for improved soda fountains, but J. D. Peck had invented a patent measure—probably a peck measure, and Perry Prettyman, of Paradise Spring Farm, Oregon, has a lamp burner. H. Sandhop has a patent pavement driver; Scripture and Stackman a car heater; E. B. Turnipseed, a beehive; D. T. Trueblood, a medicine spoon; C. E. Plugge, a tobacco cutter; and Wall Work a car signal.

Among other curious names are V. C. A. P. D. G. Compte d'Ayapruck, Lio Louis Aime Elie Picot de la Peyrouse, Gallup & Hurry, Jackson Martin Van Buren Ilgenfritz, M. J. Laughter, E. S. Laughinghouse, J. Midwinter, J. D. Miracle, Return Jonathan May, C. E. Marychurch, W. Morningstar, J. E. Mustard, Return Jonathan Meggo Only, N. W. Playmate, F. Pickup, W. Rainbow, W. G. Rawbone, M. Rainwater, W. H. Rushforth, L. Soarback, J. M. Scantlin, B. Sloppy, J. F. Sheepshank, B. Silvernail, J. Snowman, W. S. Sharpneck, D. Shirtsleeve, W. Stonebraker, A. T. Timewell, Liberty Walkup, Pleasant Witt, Twentyman Wood, M. C. Younglove, E. Children, Church & Chaplin, A. Colderhead, S. Cornfield, W. Clucken, T. Curbsetter, W. B. Cowlock, Cook Darling, O. Drinkwater, A. Doll, I. Edge, W. S. Earwig, P. T. Earlywine, Lewis Finger, S. Forehand, Amy Fullalove, D. Goodwillie, Wm. Goforth, W. H. Goodchild, J. L. Greatsinger, Sampson Goliah, C. M. Henn, T. Oxyard, W. Onions, B. Overstreet, and N. W. Playmate.

The Secretary has decided that where an applicant files two or more applications for patents for divisions of the same subject matter of invention, the references from one application to another required by rule 42 of the rules of practice relating to such cases must specify the applications particularly by stating the dates of filing and serial numbers.

There has been but little of importance done in the Patent Office during the past week, the holidays having interfered with the regular work. FRANKLIN.

### Variations of the Magnetic Needle.

An Oregon correspondent, formerly of the U. S. Land Survey, says that, in the Willamette Valley, in 1850, the magnetic needle showed a variation of 20° E., where now it is 21° 10′ E., thus indicating that the magnetic pole is there moving eastward about .2° a year. He has noticed greatest disturbance in vicinity of recent volcanic upheavals, varying as much as 20° in a mile, and suggests that the thickness of the earth's crust or the natural heat of the earth may have some effect.

TO WRITE UPON TERRA-COTTA TABLETS.—Dip the clay tablet in milk with a few drops of acid added, and then dry. When this is done you can write upon it as easily as upon paper.

### Oils and Driers.

It is very necessary that the painter should know something about the oil he uses, as well as the pigments. It is apparent to every one that has used linseed oil that, as it dries, it undergoes certain changes. One authority computes that on the average linseed oil paint or varnish takes about three months to dry. As the oil grows harder it protects itself against the air—that is to say, its surface prevents the air from getting at the oil underneath the surface. It assumes the character of a solid hard leather, which contracts in drying and pulls itself together; the effect of this pulling or contracting is to produce cracks. The contraction of oil in becoming hard, and its sudden contraction under cold, are the chief causes of the difficulty experienced in varnishing. Varnish and oil usually crack in a direction across the grain of the wood, the chief reason of which is that wood does not contract in its length, and therefore the varnish in contracting cracks. Mr. C. L. Conder, in his useful book on painters' materials, observes that "oil dried in the sunlight and exposed to the direct rays will not last nearly so long as oil in the shade. Painters assert that oil dried in the coldest weather lasts the longest; it is difficult to see why this should be so, unless on account of the small loss of not-drying oil. When the oil is dry or hard, the loss of not-drying oil goes on very slowly." We must refer the reader to the work of Mr. Conder for an examination of the causes of cracking; suffice it to observe, that all painters are aware that too thick a coat or too many oil coats in one painting will cause cracking. Speaking of driers or "siccatives," which have an important bearing upon the subject, Muckley says that gum mastic, in the mediums used by English artists, has been a great injury to their pictures, and recommends copal varnish as the best drier. Others find the siccative of Harlem, made with gums, of value; but copal was largely used as a medium by the old masters. Driers harden the oil by turning it into soap; but this also may be destructive if the oil is made too hard.—*Building News.*

### A New Belt on Saturn.

At a recent meeting of the Royal Astronomical Society, Mr. Ranyard read a note on a narrow belt which he had seen on the planet Saturn. He said that he believed narrow belts similar to those seen upon Jupiter were very rare. There were many observations of broad belts of a bluish-brown color upon the ball of the planet; but he was not aware of any other observation of a sharply defined narrow belt. While observing the planet on the evening of November 4, with an 18 inch silver-on-glass reflector, he noticed a narrow dark belt which stretched across the disk, and at moments of good definition could be seen to fade away toward either limb; but he thought that the decrease in intensity was not as marked as in the case of similar belts upon Jupiter.

The color of the belt was a dark blue-gray, strikingly different from the reddish-brown of the belts upon Jupiter. On the 4th November it was a striking object, nearly as easily seen as the Cassini division on the ring, though not so dark. He estimated its breadth as not double the breadth of the Cassini division, where it is seen broadest in the ansæ. The belt was again seen on the 13th of November, but was not then so conspicuous, and the definition was not as good as on the 4th.

On the 21st he saw it again, and it was also seen by Mr. Hopkins, who observed it with him. He had tried to find whether any other persons had seen it, and found that Dr. Copeland had on the 6th November seen a dark belt, which he described as in about 20° south latitude, sharp toward the equator, and shading off toward the pole. He estimated its breadth at about twice that of the great division in the ring. It should be remarked that taking ten and a quarter hours as the rotation period of the planet, the opposite side of the ball would have been turned toward the earth at the time of Dr. Copeland's observation as compared with Mr. Ranyard's observations of the 4th and 13th.

### A Model School Building.

Hartford, Conn., has recently completed a new high school building to replace one burned two years ago. The building is 236 feet by 100 feet, two stories high, with basement and attic; a clock tower 126 feet high and an astronomical tower 98 feet high. The building is of brick with stone trimmings, and the total cost was $255,000. The floors are on brick arches supported by rolled iron beams; the stairs are of stone on brick arches; the heating boilers are in a detached building; the walls of the main building are twenty inches thick, inclosing an air space from foundation to roof of four inches width, and the entire structure is intended to be perfectly fireproof. There are ten class and recitation rooms, play rooms for inclement weather, a hall capable of seating 1,200 persons, a large lecture room, chemical laboratory, and observatory with dome 17 feet in diameter containing an equatorial telescope with 9½ inches aperture, from the Alvan Clark manufactory, at Cambridgeport, Mass.

### A New Method of Oxidizing Sewage.

Professor J. Koinig proposes to purify town sewage and the waste waters of slaughter houses, dye works, breweries, etc., by allowing them to trickle over a network of wire, thus exposing a large surface to the oxidizing action of the atmosphere. He recommends that the coarser impurities should first be removed by means of settling tanks.

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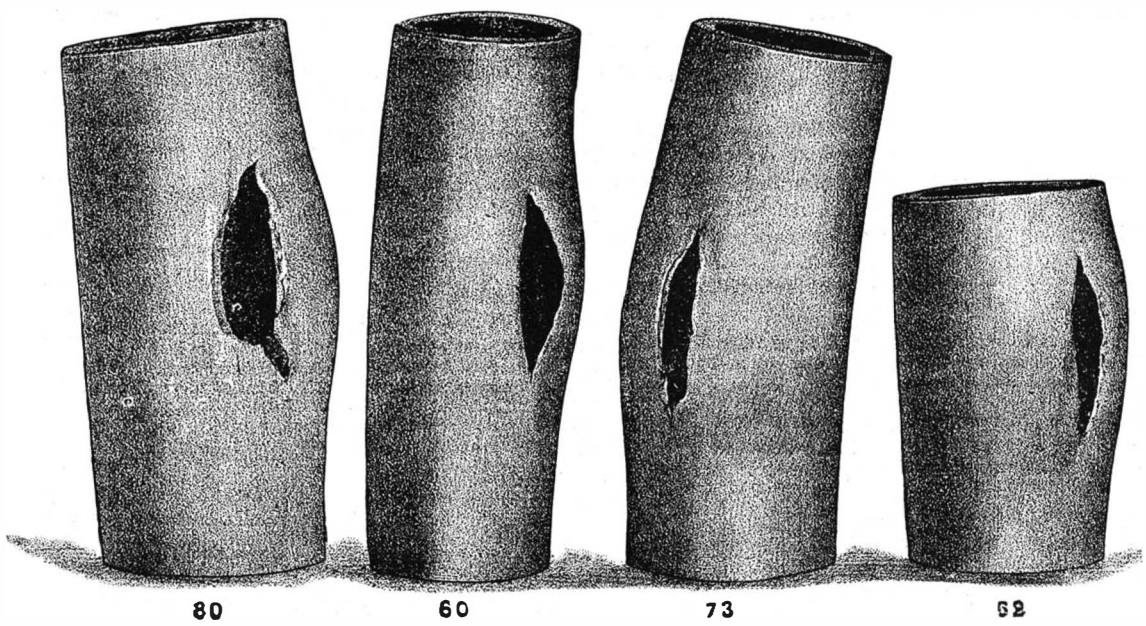
## THE STRENGTH OF LEAD PIPES.

The accompanying engravings represent the fractures of several lead pipes tested to destruction by a German firm of manufacturers, from whom the Pintsch's Lighting Company obtain the lead pipes used in the installations of compressed oil gas apparatus, by which a number of the railway companies of this, among other countries, supply their railway carriages with oil gas. After trying the lead pipes of several English makers, the Pintsch Company was forced back upon the German makers, for lead pipes which would, for any length of time, stand the high pressure—90 pounds to 105 pounds—at which the gas is distributed for charging the carriage receivers. The makers of these pipes assert that they use only pure lead, but we are inclined to think that the figures representing the bursting pressure indicate the use of an alloy. The numbers placed below the several pieces of pipe shown in the engraving give the number of atmospheres at which the bursting took place, except in the case of that marked 73, which should be 75. The external and internal diameters of these are respectively 1·5625 inches and 1·125 inches; 1·3125 and 0·9375 inch; 1·4375 and 1·0625 inches; 1·375 and 0·9375 inch.



THE STRENGTH OF LEAD PIPES.

Calculated by the formula $S=\frac{p}{\text{hyp. log. } R}$, in which R= ratio of external to internal diameters, $p$=pressure in pounds per square inch, S=stress in pounds per square inch of the material of the pipe, the bursting pressures give a stress S=respectively 3,720 pounds=1·66 tons; 2,679 pounds =1·19 tons; 3,750 pounds=1·67 tons; and 2,460 pounds= 1·1 tons; or an average of 1·405 tons per square inch of section of the lead.

M. Jardine found that a lead pipe 1·5 inches diameter and 0·20 inch in thickness sustained a pressure of 1,000 feet of water, or 29·5 atmospheres, without alteration of form. Under 1,200 feet of water, or 35 atmospheres, it began to enlarge, and it burst under 1,400 feet of water, or 40 atmospheres, having swollen to a diameter of 1·75 inches. A 2 inch pipe 0·20 inch thick sustained a pressure of 800 feet of water, or 23·5 atmospheres, with scarcely any enlargement; but it burst under 1,000 feet, or 29 atmospheres. From these results, as given by Mr. D. K. Clark, it appears that the resistance of lead to a tensile stress is equal to 15 cwt. per square inch of sectional area, and that its ultimate strength is equal to 1 ton per square inch. We are not told how long a time these pipes were subject to the lower stresses mentioned; but there is little doubt that under long continued stress enlargement would take place at lower pressures than those which equal a stress of 15 cwt. per square inch of the material, so the ratio R would gradually decrease, S consequently become greater, and $p$ less. The stress necessary to burst the pipes we have illustrated was no doubt brought to bear without much reference to the time occupied, and under the circumstances the bursting pressure might be somewhat high and would also be somewhat irregular, which probably explains the difference in the figures above given. These give a mean breaking stress of 28 cwt.; but it is not very likely that the same material in other form than that of a pipe would withstand so high a pressure, because at a slightly weak place extension commences, and though fracture is thus localized, the material is not supported by that around it.

It will be observed from the forms of the fractures, which are clearly shown in our engravings, that they are those which are usually seen in lead pipes in vertical or approaching vertical position, and are burst by frost in winter. These, as well as other fractures, are usually attributed to the expansion of water in freezing; but a little reflection will show that as this expansion takes place as the water solidifies, the fracture produced by it alone would be in the form of a long crack only wide enough to permit of the slight expansion which takes place between 39 degrees and 32 degrees Fah.

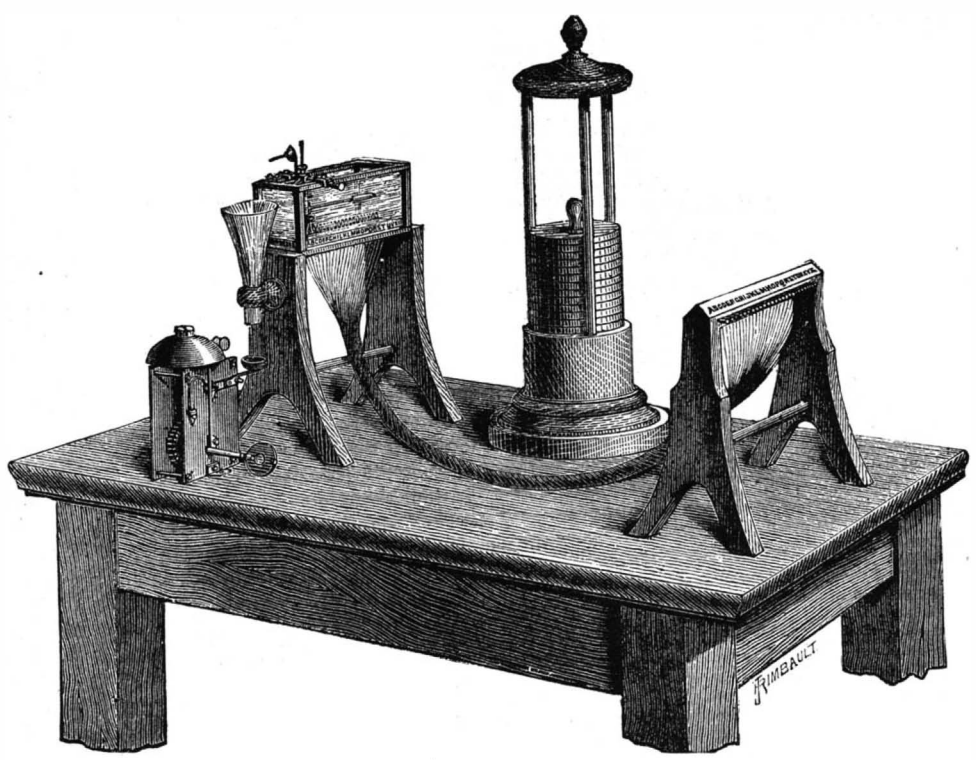
When lead pipes are burst during frost, the fracture being more or less wide, short, and localized at a considerable swelling, the bursting is not always directly due to the freezing and consequent expansion of water and solidification.

In freezing, water gives up a large quantity of its contained air, and this rises to the upper parts of a pipe, or to any part where it gets caught, as in the upper part of a bend.

As the water in the pipe falls from 39 degrees to 32 degrees Fah., or from 4 degrees to zero Cent., its volume increases from 1 to 1.000122, and this, acting on the imprisoned air, compresses a highly elastic medium, which remains under pressure even after the water has become solid. By this means the pipe is swollen and thinned where the air is imprisoned, and by a repetition of the process a burst takes place, which is assisted by the expansion of the air when the thawing sets in, the expansion of air per degree being 0·00217, which is so much greater, as above seen, than that of water.—*The Engineer.*

## SOEMMERING'S ELECTRIC TELEGRAPH.

The rapid success of Napoleon's Austrian campaign in 1809 was partly attributable to the good use he made of the optic telegraph; and when he had left the country the Bavarian minister suggested to Soemmering, a member of the Academy of Sciences of Munich, that the Academy of Sciences might advantageously turn their attention to the subject of telegraphy, the great advantages of which had been so completely demonstrated before them. Soemmering caught at the idea, and appears to have immediately recognized that electricity was the agent of all others calculated to render the required service. At that time, says *Engineering*, the only known effect of an electric current which was suitable for the purposes of telegraphy was the evolution of gas, and upon this he commenced to experiment. He first constructed a small apparatus. He made a cable of five wires insulated by sealing wax. The ends of the wires, at one extremity of the cable, were connected to gold terminals in a vessel of acidulated water, and were marked *a*, *b*, *c*, *d*, *e*, respectively.



SOEMMERING'S ELECTRIC TELEGRAPH.

The other ends were placed, two at a time, to the terminals of a voltaic pile, composed of plates of zinc, silver coins, and felt soaked in dilute acid. The contact was followed by the evolution of gas from two of the gold terminals, and thus any two of the five letters could be indicated simultaneously. The possibility of effecting the transmission of words by this system having been demonstrated, Soemmering proceeded to construct the full sized instrument shown in the annexed illustration, which was sketched from his original apparatus.

It consists of a receiver and transmitter connected by a cable of 35 insulated wires. Here the transmitter has 35 copper terminals in connection with the conductors, marked with 25 letters and 10 figures. Any pair of these terminals could be connected to the poles of the voltaic battery by flexible connections not shown in the figure, and thus a circuit established. The receiver had likewise 35 terminals; these were of gold, and were contained in a glass tank of acidulated water. To call the attention of the attendant an inverted spoon was arranged horizontally in the liquid, and collected the gases that were disengaged from certain terminals. When it became sufficiently buoyant it rose, and at the same time turned down a rod upon which there was loosely threaded a ball. The ball slid off, and, falling down a funnel, dropped into a cup at the end of a detent lever on a call bell worked by clockwork, releasing the mechanism and putting the bell into action. In signaling, the gas rose simultaneously from two of the gold terminals, the quantity from one being double that from the other, and thus two letters were sent at once, it being understood that the one which evolved the greatest quantity of gas preceded the other in the written word. This apparatus was completed in August, 1810, but it was used without the call bell in July, 1809. The first experiments were made over a distance of 38 feet, and then were rapidly extended to 1,000 feet, and, as soon as the inventor had perfected the insulation of his cable by caoutchouc dissolved in ether, to 10,000 feet. The telegraph was presented to the Academy of Sciences of Bavaria in August, 1809, to the Academy of Sciences of Paris in December of the same year, and afterward to various royal personages, but no one took it up, and although it was twenty-five years before a practical system was brought out, yet no one seems to have tried to bring Soemmering's invention into a form from which useful service could be expected.

### Superstitions about Precious Stones.

*Cornhill Magazine* in an article on the above subject concludes that the superstition that yet lingers about the precious stones represents, happily, a fast diminishing quantity. Who would think now, says the writer, of attributing to each stone a special influence over each month, and wearing, therefore, the sapphire in April, the agate in May, and so forth? Yet our ancestors did this, and even appropriated to twelve kinds of stones the twelve signs of the zodiac and the twelve apostles. Perhaps there was some pious intent in making the jasper the symbol of St. Peter, the chrysolite of St. Matthew, or the uncertain beryl of the disbelieving St. Thomas; but the modern spirit needs not these reminders, and their value at any time must have been very doubtful. But, smile as we may at the superstition that ruled in bygone times with regard to precious stones, we have to admit that it was not altogether without its brighter side. In the dark ages, for instance, it can have been no mean happiness to possess gems which, like the diamond and amethyst, reduced war to a safe and pleasant pastime. What charm have we wherewith to face the perils and misfortunes of life comparable to the faith in their talisman which supported our ancestors? Who that remembers the agitations of a law suit and the nervous reliance placed in his solicitor, but might regret the faith which in a previous age and similar plight he might have felt in a morsel of chalcedony?

Science, moreover, in many cases leaves no compensation for the belief she dispels. It was no trifling alleviation of the peasant's lot that he might hope any day to find a rich jewel left by a snake in the grass, or vast treasures hidden in a mountain.

This hope is now gone, or going, from him, and perhaps few living Cornish peasants now look for the blue stone ring which their ancestors attributed to the action of snakes breathing upon hazel.

Who now that drinks the refreshing Vouvray wine, from Vouvray, in France, would ever think that the name of both wine and place had come from an old local belief in a dragon or viper (vouivre) that possessed a single eye, or carbuncle, which it laid aside on the ground, and which, if discovered, would lead its finder to immeasurable riches?

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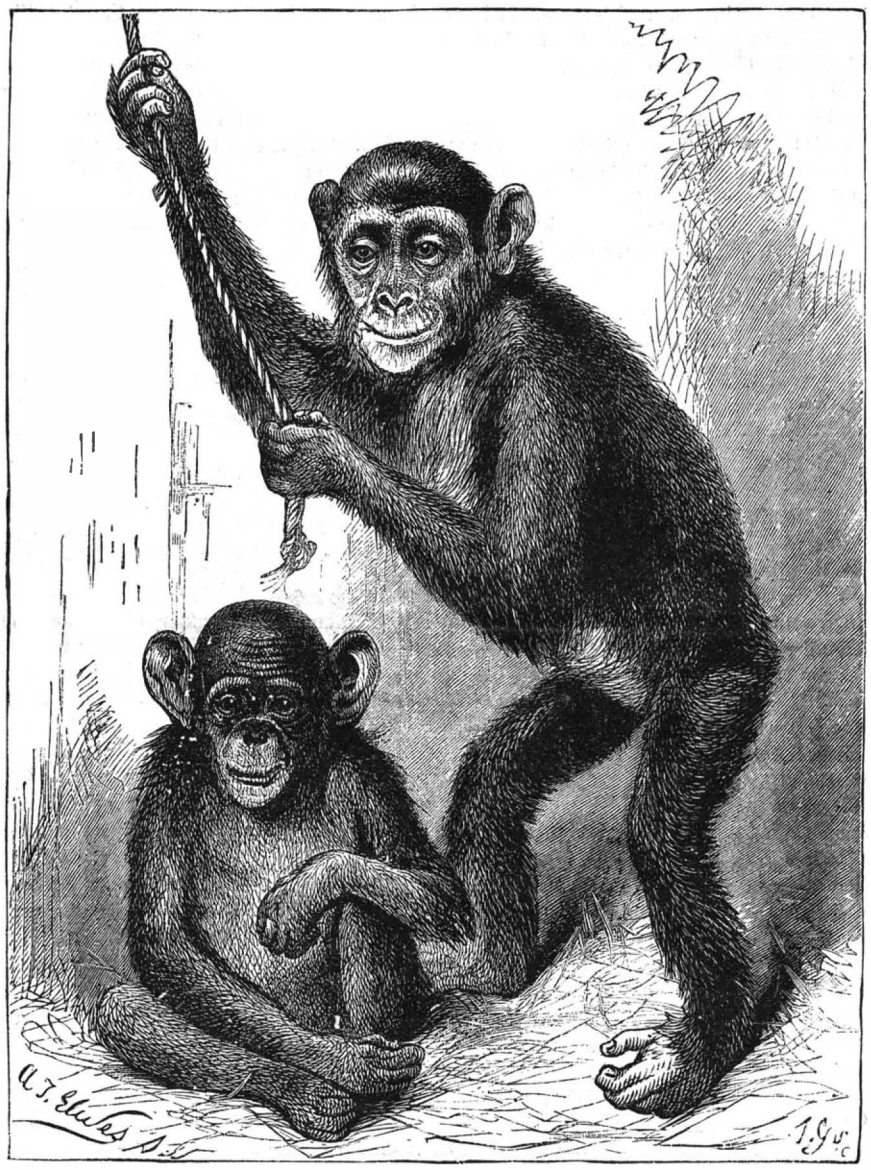
### Connecticut Valley Fossils.

At Portland, Conn., on the Connecticut River, three large blocks of freestone have been lately taken out of the quarries, 300 feet below the surface, for the Putnam high school, which are said to be the most singularly marked of any yet found there. On the upper surface of two of the blocks are visible, plainly indented, some of them being a half inch deep and sharply cut, the footprints of birds of a past age; some are large and some small. The third block has the fossilized remains of a creature that in shape resembles a turtle. It is about 1 foot and 6 inches wide, octagonal in shape, and oval like the back of a turtle, it is firmly attached to the rock, and there are no traces of legs.

### THE CHIMPANZEE AND KOOLOKAMBA.

The subjects of our illustration were purchased by the Zoological Society of London on Oct. 24; but, unfortunately, the chimpanzee, after living a few days, has succumbed, as many of this species have before, to the fatigue and close confinement of a long and tedious journey.

He was the largest specimen the Society ever had the chance of procuring, and is, consequently, a great loss. He stood, if upright, about 4 ft. 7 in.; and, although slight in comparison with some of his brethren, was of a very powerful frame. It is but seldom that these monkeys are kept alive in Europe for any lengthened time; they almost invariably succumb to cold and lung disease, owing, of course, to the changes in our climate. The other animal, the little koolokamba, is of a rarer species, and is happily thriving well. He appears to be of a hardier constitution. The koolokamba, which gets its name from saying "Koola! Koolo!" over and over again in a strong voice, dwells in the forests of equatorial Africa, and is often seen in company with the chimpanzee. This is the first specimen that has appeared in England, and is an object of great interest to zoologists on account of a certain resemblance, in some points, to the 'nschigombouvie," the chimpanzee, and the gorilla; but is unlike them all in its general appearance, which is rather frog-like. It has an immense belly, and is a vegetable feeder, like all the troglodytes: its skull is globular, it has long ears, and seems to have great intelligence, or rather cunning. Its gait is like that of the gorilla in walking on all fours, resting on the backs of the fingers. We may congratulate the Society upon the acquisition of so valuable a specimen of this rare little creature.—*Illustrated London News.*



THE CHIMPANZEE AND KOOLOKAMBA.

### The Alaska Volcano and Tidal Wave.

The Kodiac, eleven days from Kodiac, arrived Dec. 27, and Capt. Cullie, together with C. T. Sands, talked with a *Bulletin* reporter at the office of the Alaska Commercial Company. Mr. Sands says that the tidal wave came about thirty minutes after the eruption, and from shore it appeared like an approaching wall of water. Had the first wave come at high tide, Mr. Sands thinks the little settlement at English Bay would have been obliterated and the inhabitants drowned. The interval between the waves runs about five minutes. The receding waters of the first wave carried the fishing boats from the river to the sea, and the next wave stranded the boats high on the beach. Mr. Sands and others noticed along in the month of August that the mountain in Chernaboura was emitting smoke, but there seemed to be no other premonition of the great explosion which occurred at eight o'clock in the morning of October 6. The shower of ashes followed soon after the rumbling was heard, but the earth did not quake or tremble perceptibly. It was remarked by Mr. Sands as something unusual that the fishes disappeared from English Bay on the night of the 5th. On the morning of the 6th not a fish could be caught or a sign of one seen. The atmosphere was warm, evidently heated by the shower of ashes, which obscured the sun and rendered the place as dark as night for two hours. Looking at night to the west from English Bay to Chernaboura, a distance of forty-nine miles, the spectacle was grand and awe-inspiring beyond description. Columns of lurid smoke and flame seemed to shoot from the earth to the heavens. No one has approached nearer than ten miles to the island since the eruption. At that distance the low ground of the island seemed to be a vast crater from which smoke and fire were issuing.—*San Francisco Bulletin*

### Disappearance of Lake Tulare.

Tulare Lake once had an area of 1,736 miles, and depth sufficient for steamboat that navigated it, but its area has been reduced to 196 miles and its greatest depth is only 22 feet. Its contraction is attributed to the absorption of water for irrigating purposes from the two streams that feed it. Some San Franciscans who have just returned from a visit to the lake predict its utter absorption, as every farmer who settles near it digs a new canal for irrigation. There are about forty artesian wells within a radius of forty miles around the lake.

### Naturalist Club of Victoria.

Before the Field Naturalist Club of Victoria, Mr. Thomas Harrison contributed a paper on the habits of certain spiders, which we find reported in the *Federal Australian.* It was stated that on placing a large spider on the web of a much smaller but very fierce one, suspended across an old water-butt, the latter deliberately cut the web, and allowed the intruder to fall into the water. After about two hours the spider so unfortunately situated was nearly drowned; and was then hauled up, killed, and eaten. A spider, an immense epira diadema, was placed within a glass case, together with a small tarantula. Next day they were found to have actually eaten each other, only the thorax, head, and a few of the legs remaining. Yet they severally held on by means of their respective mandibles, with an eminent deadly grip, both being quite dead. Six spiders, of the species found under the bark of the eucalyptus, were confined under a tumbler, a bull-dog ant being subsequently introduced. The ant speedily killed five of his fellow prisoners, but on approaching the one remaining the latter turned round, and ejecting several threads of web, succeeded in embarrassing the ant. This done, the spider became the assailant, and rushing upon his antagonist almost bit him in two. Spiders are usually brave; but a tarantula dropped upon an ant-hill in most cases curls up his legs and makes no attempt either to run away or to defend himself. If attacked by a large hornet, the spider generally behaves in a similar manner. On the other hand, one species of spider having very large mandibles strives vigorously, and nips many of the ants venturing to approach him. One particular kind of spider, with long legs, very common in dwelling houses during the autumn months, when touched with the finger commences to sway itself to and fro, continuing the motion for one or two minutes. The late Mr. Darwin supposes that the spider resorts to this practice in order to render himself invisible, but it may be remarked that the trick fails entirely so far as the human eye is concerned. The webs of spiders vary very much as to form and arrangement. Some are of a perfectly polygonal shape, and are supported by a number of threads radiating from the center. In some cases there are only a few radial threads, the interstices between them being filled up with short straight lines, which form quadrangular spaces, and present a general appearance resembling that of a Greek bordering. In other webs the threads are arranged in an irregular manner, so that the entire structure of the web reminds one of the intricate maze of the rigging of a full-rigged ship, while one species of spider does not suspend its web at all, but attaches it flatly upon a wall or door. In this latter case the threads are evidently covered with an extremely viscid substance, which retains any insects accidentally alighting thereon. The "vibrating" spiders, if placed on the bottom of a tumbler reversed and standing in a plate filled with water, throw out a web, which, adhering to some adjacent object, forms a sort of aerial suspension bridge by means of which the spider escapes from captivity. The spiders found under the bark of the eucalyptus, if thrown into water, eject threads of web, and these, being wafted ashore, enable the spider to speedily haul itself to dry land. A spider inclosed on a sheet of paper within a circle of wet ink, to all appearance ejected a thread perpendicularly upward until it attached itself to the ceiling. The spider then climbed up the thread and escaped. Some fifty or a hundred common house flies were once noticed to swarm round and follow, for more than a hundred yards, a gossamer spider floating through the air, supported by the quasi balloon which this species is known to construct. This habit of the gossamer is well known to naturalists, but the behavior on the part of the flies has never been previously observed.

### Wonderful Insect Eyes.

Physicians call attention to the increasing instances of defective or imperfect sight occurring in civilized countries, and attribute it to various conditions of modern life—the overwork of the eyes in childhood, the study of books in small print, the habit of reading by imperfect light, and many other causes. It appears certain that in the matter of eyesight the savage has usually the advantage of the civilized man. The gift of sight is one very unequally distributed among the animal world. Some creatures enjoy it in excess, like the eagle; others are totally deprived of it, like the earthworm. In many other instances the sense of sight, if not actually lacking, is extremely imperfect, as in the case of the mole. Insects are in many cases far more richly endowed with eyes than even birds or beasts. The little creature called a whirlwig (*Gyrinus natator*), which skims about on the surface of standing water, is furnished with a double set of optics, the upper portion of the eyes (fitted for seeing in the air) being placed in the upper portion of the head, and the lower portion of the eyes (fitted for seeing in the water) in the lower portion of the head, a thin division separating the two. Spiders possess six eyes—some species eight; centipedes twenty, while the eyes of many insects (bees, butterflies, dragon-flies) are composed of a number of facets, each eye being, in fact, a cluster of eyes. Dr. Hook counted 14,000 of these facets in the eye of a dragon-fly, and Leeuwenhoek found as many as 12,544 in another specimen of the same species. The latter naturalist adapted one of the eyes of a dragon-fly so as to be able to see objects through it by means of a microscope, and found that he could view the steeple of a church 299 feet high and 750 feet from the place where he stood; he could also distinguish if the door of a house, at the same distance, was open or shut. Fleas' eyes diminish as well as multiply objects, as Puget discovered by performing a similar experiment to that of Leeuwenhoek. "A soldier viewed through it represented an army of pygmies; . . . the flame of a candle seemed the illumination of a thousand lamps." Blind or imperfectly sighted human beings may think with envy of the beautiful provision of visual organs bestowed by Nature on some of her children; and yet many creatures live happily with but a small share of the blessings of sight. In some of the insects who possess the largest share of visual organs, some other sense—taste, hearing, or touch—is deficient. Huber believes their sense of both hearing and taste to be imperfect. On the other hand, the blind earthworm will retreat rapidly into its hole if the light of a candle is thrown upon it, its sense of hearing or smell warning it of the approach of the danger it cannot see. A bat's senses of touch, hearing, and smell are so acute that it depends little on the aid of its eyes. Spallanzani tested this by the cruel experiment of destroying the sight of several bats, and then setting them free. In their flight through the room they avoided even the smallest thread placed to obstruct their way. Latreille, the French naturalist, states that there is a species of ants which are entirely blind, but pursue the same mode of life as their sighted brethren.—*London Globe.*

### The Wonderful Sunsets.

Concerning the wonderful phenomenon of our sun risings and settings of late, and the suggestion that it may be caused by volcanic dust from earthy or lunar volcanoes, I have this remark to make: If it were caused by such dust or mist, it must sensibly affect the rays from the moon and sun, whereas no such effect is perceivable. Heavy and dense as that mist appears the moon rises from and sets below it with not the slightest diminution of its power to shine. The same may be said of Mars and Jupiter. Jupiter rises now in or near the Crab. I do not see that it affects the rays of any star. If it does not, then we may conclude that the cause exists far beyond the most distant star. Those who have the opportunity of ascertaining if these speculations are correct should report. Certainly it would seem that the cause of the phenomenon lies far beyond the orbit of our sun.

C. I.

Oregon, Mo.

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### Sorghum Sugar Experiments.

Prof. Collier, late chemist of the Department of Agriculture, and a firm believer in the practicability of producing sugar from sorghum in sufficient quantities and of a quality to supply a great part of the demand for sugar in this country, appears to have awakened the interest of the Agricultural Department in a subject about which it was supposed to have become somewhat inefficient. According to a Washington correspondent of the New York *Times*, Prof. Wiley, of the department, in a forthcoming report, will make public some interesting information about the experiments with sorghum during the last year, and takes a more hopeful view of the subject than Commissioner Loring formerly held. He pronounces erroneous the prevalent impression that every farmer may become his own sugar-maker. Sorghum, unlike sugar-beet, contains various non-crystallizable sugars, the separation of which demands much skill and scientific knowledge. Sorghum sugar will have to be made in large factories. The existing factories have shown that it can be made, but how profitably or unprofitably cannot be stated by Prof. Wiley, who suggests that farmers near factories may, in effect, make their own sugar by raising the cane and trading it at factories for sugar.

Cane giving 60 pounds of sugar per ton ought to bring the farmer 35 pounds, the rest of the sugar and molasses going to the manufacturer to pay expenses and yield profit. The profitableness of making sugar from sorghum depends largely on utilizing all waste products. The scums and sediments make manure hardly inferior to guano. Bagasse, or crushed cane, can be turned into manure by being thrown into hog pens, as at Rio Grande, N. J., or it will make a fair quality of printing paper. It is not economical to burn it. If the manufacture of sorghum sugar is proved to be profitable, it will result in supplying to a large extent our demand for sugar; but as sorghum makes a great deal more molasses in proportion to sugar than sugar cane does, the Professor concludes that when there is enough sugar there will be a great deal more molasses than can be disposed of.

Prof. Wiley has made experimentally some fair samples of rum and alcohol from sorghum molasses. Under favorable circumstances one gallon of molasses, weighing 11 pounds, would give 2·75 pounds absolute alcohol, 3·03 pounds of 90 per cent alcohol, and 5·5 whisky or rum. Thus, each gallon of molasses would give nearly half a gallon of commercial alcohol and two-thirds of a gallon of whisky or rum.

As it has been abundantly proved, he says, that sugar can be made from sorghum, the Government should make no further experiments in this direction. Prof. Wiley has tried the diffusion process, and finds it yields 20 per cent more sugar, but at a somewhat higher cost than grinding. The Government, he thinks, should purchase machinery for large experiments in the diffusion process, and should raise its cane somewhere else than near Washington, as land there is expensive and not adapted to the purpose. The Government should also make arrangements with agricultural colleges or other agencies in various States for experimenting with sorghum culture to determine what parts of the country are most favorable to the culture of sugar-producing plants. Prof. Wiley suggests in each State the trial of two acres divided into ten plots—five for sorghum, four for beets, and one for corn—to test for purposes of comparison the general fertility of the soil and the character of the season. The Government ought to carry on for a series of years the process of selection of sorghum seed, in order to secure an improvement in the quality of the cane. It may be stated that the past season proved a disadvantageous one for sorghum sugar making, not only at the Agricultural Department, but generally. The conviction is growing among some of those who have made experiments that sorghum cannot be relied on to make sugar in the extremely Northern States, but that in spite of occasional successes in Minnesota there is a sorghum belt, as there is a corn belt, north of which the crop cannot be relied on.

### Railway Bridge Inspection.

Bridges, like car wheels, do not break down without showing signs of weakness long in advance. Careful inspection of wheels at frequent intervals has enabled railways in this country to practically eliminate "broken wheels" from among the causes of accidents, at least those of a serious nature. A bridge failure is admittedly of a much more dangerous character than one resulting from a broken wheel. It would be expected, therefore, that bridges would be much more carefully looked after than wheels; yet, on some roads, even in the vicinity of New York, faulty and dangerous structures of this class have been allowed to stand on main lines for the last five years. Nominally, these bridges have been inspected, and probably the flaws have been reported, but so long as no attention is paid to the defects the inspection is a farce. A dangerous wheel on the same road, if allowed to run under a passenger car, would cause the instant dismissal of whoever allowed the car to proceed, knowing that it was defective.

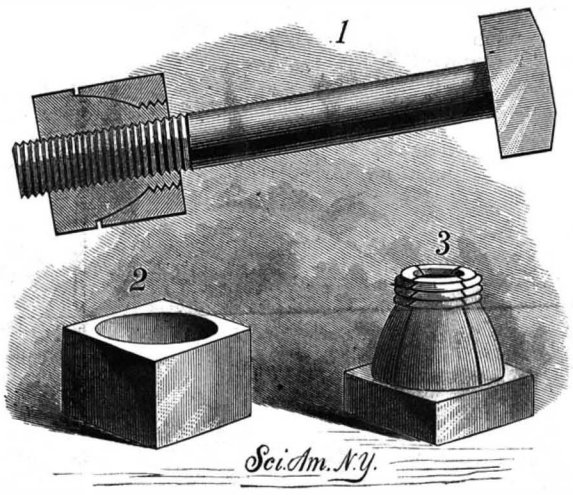
If the true, or inside, history of many bridge accidents could be written, it would be found that numerous warnings had been given and disregarded. The condition of the structures had not been hidden from the officers, and had been continued long after they had passed the point where danger was imminent at each passage of a train.

One of the bridges alluded to as having been a long time defective showed its first sign of weakness by the cracking of a cast iron member. This crack has been slowly enlarging. Another member, through a mistake in placing the braces, is relieved from its proper load under certain conditions, and has been slowly rotating about its horizontal axis. At any moment, however, it is liable to experience a heavier shock or stress than usual and turn over completely, or break from the application of a strain in a manner not contemplated by the designer. These facts have been known to the officers of the road for a long time. Attention has been called to this particular bridge not only by their own inspectors, but by outside engineers.

It is hardly necessary to add that engineers do not generally believe that bridges, roof trusses, buildings, or boilers fail from weakness or decay that could not have been discovered by proper examination. Mysterious causes are no longer admitted by engineers of repute to have a place in engineering science. However, the inevitable conclusion is that failures of all kinds of engineering structures may be anticipated and prevented by taking proper precautions.—*The National Car Builder.*

### NUT LOCK.

The bolt is of the ordinary form and of any size of thread. The nut, Fig. 3, is threaded throughout its aperture to fit the bolt, and is formed at one side with a conical extension terminating in a cylindrical portion that is threaded. The extension is formed with longitudinal incisions, of which there are, preferably, four. The washer, Fig. 2, corresponds in width with the extension of the nut, and has its aperture tapered to fit the conical surface, and also has a straight portion that fits the threaded cylinder. These threads correspond in the number to an inch with those on the bolt, and the conical surface is slightly swelled, as shown in Fig. 3. To use the device, the washer is first placed on the bolt against the body to be clamped, when the nut is screwed on the bolt, its extended portions entering the washer until the threads on the end take the threads on the washer; the conical surfaces coming together, the nut is clamped on the




FULWILER'S NUT LOCK.

threads of the bolt. The nut is held fast by the clamping action, and the washer cannot become loose for the reason that it must, to do so, move back against the pressure of the body. This construction gives a long threaded surface to the nut, so that the pressure cannot strip the thread. The smooth conical surfaces commence to clamp as soon as in contact and increase in pressure as the washer moves up the cone.

This invention has been patented by Mr. J. A. Fulwiler, of Lexington, Illinois.

### Better Prospects.

It is evident to one who gets about among the manufacturers that there is a more hopeful feeling regarding business than there was at the beginning of December. Machine tools of the standard sorts are ordered to a much larger amount than at that time, and some establishments are keeping their men busy in getting a stock of these tools ahead, which, of some makes, are rarely a drug in the market. The demand for special tools has somewhat fallen off, as might have been expected when the newly started manufactories of the last building season were completed, but there is a call for small machine tools fully as imperative as a year ago, one manufacturer of small machine tools and appliances reporting that he has all that his means will enable him to undertake, and another, who commands the production of two styles of patented planer and lathe tools, stating that two men on the road are doing well for themselves and for him in their sale.

### Tobacco and the Pulse.

Dr. Troitski has made a number of observations upon the effects produced on the temperature and pulse by smoking. He found that in every case, varying according to the condition of the individual, there was an acceleration of the pulse rate and a slight elevation of temperature. If the average temperature of non-smokers were represented by 1,000, that of moderate smokers would be 1,008; and while the heart in the former case was making 1,000 pulsations, in the latter it would beat 1,180 times. It is in the latter effect that he thinks the danger of tobacco smoking is manifested.—*Journal de Medecine de Bruxelles.*

### How to Make Burnt Cork.

The popular impression about the application of burnt cork by minstrel performers is that it is rubbed on the face and hands of the performer from a cork whose end is charred in a convenient gas jet. This is incorrect. To supply the burnt cork used by minstrel performers of this city occupies the entire time and earnest attention of one interesting character. A little man, whose place of business is on the curbstone on the north side of Pine Street, explained to a reporter the process of making it.

"I first gather my corks. I get them from the big bottling houses, who buy lots of bottles, many of them with corks that wouldn't keep the air out of wine or beer.

"When I get ready to burn, I put the corks into those three washboilers you see there with holes punched in their sides and bottom, sprinkle alcohol over them, and set them afire. Then I fill one of those muslin sacks with the charred cork, and knead the sack in this barrel of water. That forces the powdered charcoal through the sack into the water.

"When I have worked all my charred cork through this sack into the water, I drain the water through a close canvas sack you see on that frame there, and what remains in the canvas sack is ready for the artists. I put it up in one pound tins, and they use it out of them. When a performer is ready to 'black up,' as they call it, he takes a little of this black paste in his hands and washes his face, neck, and hands in it, and he is blacked as you see him on the stage."—*San Francisco Call.*

### A Remarkable Phenomenon seen in Porto Rico.

A correspondent in Humacas, Porto Rico, describes a beautiful comet observed by himself and a few friends in Humacas on the 21st of November, 1883, between nine and ten o'clock in the evening. He writes that "its head inclined to the west and its tail extended majestically due east, and at an altitude of about 35° to 40°." It was observed on "three successive nights, but on the fourth night it disappeared."

The writer asks for information, and asserts his belief that he has seen again the great comet of 1882. His conclusion is an utter impossibility. The great comet of 1882 is now far beyond the reach of mortal vision. Moreover, it was visible in the morning instead of the evening. The latest observations of this comet were made by Dr. Schmidt at Athens, on the 27th of April; by Mr. Atkinson, of New Zealand, on the 6th of May; by Mr. Maxwell Hall, at Kempshot, Jamaica, on the 6th of May; by Prof. Ricco, at Palermo, on the 12th of May, when it was extremely faint. The very last observation was made by Mr. Thome, assistant at the Cordoba Observatory, in South America, where it was seen until the 1st of June, and described as "an excessively faint whiteness."

It was announced that this comet would be in a position during September and October where it would probably be visible in a powerful telescope in the early morning, when the moon was out of the way. We have heard no report of its visibility, and therefore conclude that it is winging its flight through the star depths to return no more until the passage of several hundred years will complete its circuit, and bring it safely back to our domain.

Neither can the comet seen at Porto Rico be the Pons-Brooks comet, now plainly visible in the northwest as a small nebulosity with a very small tail when seen by the naked eye; and as a nebulous mass with a bright nucleus and a well defined tail, when seen in a telescope.

We cannot therefore throw any light upon the celestial phenomenon seen in Porto Rico by our correspondent and his friends. A comet such as he describes would have been seen elsewhere, and its presence would have been telegraphed all over the civilized world. We should like a drawing of the strange visitor and its position among the surrounding stars. We should like also to know whether the observations were made with the naked eye or with the aid of the telescope.

Perhaps the Java earthquake had some connection with the beautiful phenomenon. The superb sunrises and sunsets occurring nearly at the same time are traced to this source by scientific men of the highest authority. Cosmic dust takes on wonderful forms, under the right conditions for development.

### A Young Electrician's Theory.

An Ohio boy, who wishes to make electricity his life study, sends us his theory of its generation. He believes it is made by the earth being hot in the interior acting on the cold at the poles, which are supposed to be of platinum; that thus electricity is given off, not only to make the auroras so frequent in high latitudes, but to charge the whole stratum of air around the globe, the atmosphere in this way acting as a storage battery.

In regard to matters where the wisest have thus far obtained so little satisfaction, our young correspondent expresses himself in a way which indicates a thoughtful observance of what is going on in this most interesting field.

THE Oxide Bronze Company, of Philadelphia, send us certificate of result of testing, for tensile strength, of a sample of their oxide bronze. The sample tried was of the area of 0·5574 sq. in. in cross section, and broke at 20,350 lb., equal to 36,502 lb. per sq. in. This bronze is a new composition for which many advantages are claimed.

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## Correspondence.

### The Origin of the California Coast Mountains.

*To the Editor of the Scientific American:*

During the meeting of the American Association for the Advancement of Science, it was interesting to observe the different opinions held by geologists respecting the geological changes that were brought about during the glacial period. Some of the members declared that they did not believe that glaciers have ever been an important geological agent, and that the phenomena usually ascribed to glacial action in the record of an ice period were generally due to icebergs. While, on the other hand, others asserted that during the glacial epoch heavy ice sheets covered most of the elevated portions of western North America, as far south as the 36th parallel of latitude; and that eastern North America was overspread with ice, which attained a depth of between five and six thousand feet. This last declaration supports the views of Professor Hitchcock and others, who believe that the ice sheets of New England were able to move their debris over wide lands of little declivity toward the sea; their immense deposits forming the lands of Cape Cod, and also the large islands of Nantucket and Martha's Vineyard. Glacialists also maintain that even greater work has been performed by ice sheets in other countries.

Professor James Geikie states, in his discussion on the glacial deposits of northern Italy, that the deposits from Alpine ice sheets of a frigid period, "rise out of the plains of Piedmont as steep hills, to a height of 1,500 feet, and in one place to nearly 2,000 feet. Measured along its outer circumference this great morainic mass is found to have a frontage of 50 miles, while the plain which it incloses extends some 15 miles from Andrate southward." As the foregoing statements represent only a few of the great geological changes declared to have been brought about during past ice periods, I am prompted to offer my views on glacial work performed on a portion of the Pacific shores of our country, which seems to me to have been much more extensive than hitherto supposed.

Professor Whitney describes the Coast Mountains of California as being made up of great disturbances, which have been brought about within geologically recent times. And this statement I found to be so obvious, while journeying in that region, it appeared to me that the Coast Ranges originated in a different manner from the older Sierras. The western sides of the latter mountains everywhere showed the great eroding power of ancient glaciers; and when I considered their favorable position for the accumulation of snow during a glacial period, I was led to seek for the glacial deposits adequate to represent the great gathering of ice which an age of frigid temperature would produce. But it seemed to me that such deposits could not be found in the foot hills of the Sierras, which contain the moraine of inferior ice sheets that terminated at the base of the mountains. Under these considerations I came to the conclusion that during the earlier ice periods the immense glaciers which formed on the western slopes of the Sierra Range moved their gigantic heaps of debris so far seaward as to form the range of hills now existing next to the coast-line; the Contra Costa, or middle, range being formed during a subsequent ice period in the same manner as the hills next to the coast line. Still, it may be that neither of the Coast Ranges was the work of a single ice period, but the western range must necessarily have been the earliest deposit.

Although the Sierras differ from the coast hills in composition, it does not disagree with the glacial origin of the latter region, from the fact that the ice sheets while moving their bulk westward displaced the deposits of such bays, lakes, rivers, and marshes as lay abreast the Sierra slopes; the moving ice sheets, thousands of feet in depth, pressed and plowed below the somewhat superficial Cretaceous and alluvial strata which lay in their course. The disturbed strata, while pushed along in confused heaps in front of the ice, were amassed in ridges sufficient to form the hills of the Coast Ranges. The bowlders found embedded in several of the coast hills must have been moved by ice from the Sierras, on account of the Coast Ranges not having a rocky core of sufficient firmness to give shape to such bowlders. Moreover, the temperature of the Pacific waters would not be favorable for glaciers to form on the Coast Ranges with the ice sheets of the Sierras terminating at the foot hills.

The Sacramento and San Joaquin valleys are now covered by recent river deposits, therefore the glacial drift which should be traced from the Sierras to the Coast Ranges is concealed. But the abraded appearance of exposed solid rock at the base of the foot hills, and also the scattered bowlders which gradually disappear beneath the diluvial deposits of the plains, indicate that the Sierra ice sheets could not have ended at the foot hills, but must have moved further westward while pushing immense accumulations of earth in their front. The Coast Ranges in several places have been subject to igneous action, which may have been brought about through heat generated from pressure exerted on the interior masses after the ice had melted away; the heat thus produced being sufficient to cause outbursts of lava, where the nature of the material favored combustion. The low plains, lakes, and bays which separate the Sierras from the coast hills are in a position similar to the shallow sounds which separate Nantucket, Martha's Vineyard, and Long Island from the inferior slopes of the mountains of New England. Therefore, while agreeing with glacialists who believe that great geological changes have been wrought by ice sheets in Italy and New England, it appears to me that the ancient glaciers of Sierra Nevada have accomplished far greater work, owing to the Sierras being situated in a more favorable position to receive and condense the humidity from the ocean. Hence, with a low temperature vast quantities of snow would gather on their lofty sides, and at the same time their longer range and greater declivity would cause the ice sheets to move down their steeps with greater force than the glaciers which passed over New England.

C. A. M. TABER.

Wakefield, Mass., January 4, 1884.

### Screw Threads and Nuts.

*To the Editor of the Scientific American:*

Some fourteen years ago, while experimenting with materials for armor plating, I became convinced that the standard V-shaped screw threads were very much too coarse, not only for armor plating, but for nearly all mechanical purposes, and that the sizes of nuts were out of all proportion to the strains required to break the corresponding bolts.

A brief statement of these facts was inserted in Professional Paper No. 17, Corps of Engineers, printed in 1870; but my attention was diverted to other duties before I had a chance to test the matter experimentally, and it was not until last month that a convenient opportunity occurred.

Having occasion to use a large number of bolts in building iron lock gates for the Muscle Shoals Canal, I had four test bolts made, two of which had the standard threads of six to the inch, and two with double that number. They were made of the same quality of iron, forged at the same time, and no special care was taken in fitting the nuts. The shanks of the bolts were turned and the heads and nuts were finished up in the usual way. The heads were only $1\frac{5}{8} \times 2$ inches square, and the nuts were the standard size for $1\frac{1}{4}$ inch bolts, or about 60 per cent of the weight adopted for $1\frac{1}{2}$ inch bolts, which was the size to be tested. The outside of the thread was reduced one-twentieth of an inch smaller than the shank of the bolt, to prevent injury to the thread in driving the bolts to their places.

These bolts were carefully tested on the great machine at the Watertown Arsenal under direction of Major F. H. Parker, U. S. Ordnance Corps, and there was not only no sign of stripping the thread or splitting the nut in any case, but the bolts with fine threads stood an average of 78,400 pounds, while the coarse threaded ones broke at 66,325 pounds. The shanks of the bolts, which were 7 inches long, were stretched over $4\frac{1}{3}$ per cent in case of the fine threaded bolts and only 2 per cent in case of the coarse ones; which shows that the "work" of breaking the former was more than two and a half times as great as in case of the standard bolts.

The tensile strength of the iron was found to be 59,785 pounds per square inch in the coarse threaded bolts, and 58,495 pounds in the fine ones; which shows conclusively that the foregoing results are due entirely to the additional cross section secured by using the fine threads.

It is by no means doubtful that even better results can be obtained by adopting still finer threads, as 16 or 18 to the inch would not be likely to strip, unless very badly fitted or worn out by frequent turning on and off, in which cases a coarser or a different form of thread is necessary.

In most cases, however, it is evident that a *net saving of at least twenty per cent* can be made *by using a finer thread*, which is absolutely easier to cut than a coarse one, and *forty per cent can be saved by making* the *head* of the *bolt* and *nut* that much lighter.

W. R. K.

Chattanooga, Tenn., January 3, 1884.

### Acoustic Vibrations.

*To the Editor of the Scientific American:*

The experiment here described, though containing nothing new to those familiar with the principles of acoustics, may be of some interest to a class of your readers who are students of this science, especially as I doubt not it is something not very often occurring on such a scale, in even the most noted laboratories of the country.

In illustrating the longitudinal vibrations of rods and tubes, I held firmly in one hand, at about the middle, a large glass tube, and rubbed it back and forth with a wet woolen cloth held in the other hand. The sound produced was quite loud and piercing, and was of itself sufficient to excite the interest of a large class seated before me. So energetic, indeed, was the vibratory motion that I felt rather apprehensive for the safety of the tube. Suddenly a sort of crash came, just *below the hand* that held it, and the tube for a length of nearly three feet was shivered to many pieces. The fragments were, I suppose, of a mean length of two inches, and the tendency was to break into rings somewhat approaching the wave-length of the vibrations constituting the sound emitted.

The tube was above 6 feet long, about 2 inches in diameter, and the glass more than an eighth of an inch thick. It will be seen from these dimensions that it was quite a stout pipe, and the effort to break it with the hands, even across some point as a fulcrum, as the knee, would have involved the exertion of a great deal of strength. Yet there was very little muscular strength exerted, and that not directly against the strength of the material. Moreover, the shattering occurred in the half *below* the hand, and was not of the part rubbed by the cloth.

J. F. B.

Emory College, Oxford, Ga.

### The Tidal Wave of Earthquakes.

M. Ferdinand de Lesseps has communicated an interesting note on this subject to the French Academy of Sciences. On the 27th of August last, after 4 P. M., the sea level at Colon, on the Atlantic side of the Isthmus of Panama, began to oscillate, as shown distinctly by the marigraph of the Inter-Oceanic Canal Company. In amplitude the oscillations equaled the usual tidal rise, but succeeded each other at intervals of one and one and one-half hours instead of 12 hours, as in the case of the normal tides. The curve of the marigraph showed that between 3:30 P. M. and 1:30 A. M. the sea oscillated eight times with a rise of from 0·30 to 0·40 meter. The movement began with an ebb of the water, as if a hollow had been made in the sea, and gradually diminished after 1:30 A. M. on the 28th, till 11 P. M. on the succeeding night. M. De Lesseps can connect this phenomena only with the volcanic eruptions in the Straits of Sunda, near Java, which began on August 25th, and reached their height during the nights of the 26th and the 27th of August. The island of Krakatoa disappeared under the water in the west entrance of the straits. The maximum tidal disturbance at Colon lasted ten hours, and began on the 27th at 2:30 P. M., which, allowing for difference of longitude between Sunda and Colon, corresponds to 4 A. M. on the 28th. The time of propagation of the aqueous disturbance is therefore thirty hours. Curiously enough, no such disturbance was registered on the marigraph of Panama, on the west side of the isthmus, although there is a straight sweep of ocean to Sunda, whereas to reach Colon the wave would have to turn round the African continent, surge up the South Atlantic Ocean, and penetrate the Caribbean Sea. But M. De Lesseps explains this anomaly on the supposition that the innumerable islets and coral reefs to the north of Australia would break the force of the waves in traveling to Panama, whereas in the deep water of the Great Ocean it would continue to propagate itself, and follow the line of the great equatorial currents round Africa and into the Gulf of Mexico.

While upon this subject we may mention, says *Engineering*, that the tidal waves occasioned by the eruption in question have committed serious damage on the low coasts of Java and Sumatra. The French coast marigraphs at Rochefort, Socoa, Fort Boyard, Cherbourg, and Havre also showed traces of the tidal disturbance mentioned by M. De Lesseps. Taking the times of these tidal waves and those of the great shocks at Sunda, M. Bouquet de la Grye calculates that the speed of the tidal waves was about 305 miles per hour. Other data from the marigraphs of Mauritius give the speed at 186 miles per hour and 362 miles per hour, the latter being a more correct estimate. The length of a wave at a given moment is reckoned at 376 miles. The Straits of Sunda are in rough numbers 12,600 miles from the coast of France.

### Effect of Climate on Railroad Ties.

At a recent meeting of the Institute of Civil Engineers for Ireland, a paper was read on "Railroad Ties in Mexico," from which we extract the following: "The sleepers used are nine feet long, ten inches wide, and five inches thick. The selection of suitable wood for sleepers has occupied much attention. Good, well creosoted Baltic sleepers have been tried on a large scale, and found to become decayed and useless at the end of about four years. Hard, strong oak sleepers, obtained in the country, have also been tried in large quantities, and found not to last more than three or four years. The timber of both the Baltic and oak sleepers seemed to undergo a rapid change and become quickly converted into a dry, spongy consistency.

There was no appearance of insect ravages; the timber had evidently not been able to withstand the great heat or dryness of the atmosphere. The best wood yet discovered for sleepers is zapote. It is essentially a tropical timber, and is exceedingly durable for outdoor or indoor work above or below ground. Samples of this wood taken out of buildings said to have been erected more than two centuries ago did not show the slightest signs of decay; the wood was as sound as the day it was put into the building. This wood, however, is very scarce and very expensive. In color it is nearly as dark as logwood. It is very heavy and sinks in water, and is so hard that the boring of the holes for the spikes and forming the grooves for the rails is very laborious work. It appears to be almost impervious to decay, but it has a tendency to split if exposed to the heat of a tropical sun for a few months. For this reason the zapote sleepers must be kept equally covered with ballast.

The next best quality of timber yet found in the country, and of which by far the greater number of the sleepers on the line are made, is sabino, a species of cedar. The general color of the wood is either a light yellowish brown or a light pink, and in appearance is very similar to the cedar used for ordinary lead pencils. It is a resinous wood, with a peculiarly fragrant odor, and is straight grained, readily worked, and does not appear to be attacked by any insects. In many of the very old buildings on the upper plains, beams and posts of this timber are still standing, and show very little signs of decay. For sleepers it is very durable, and those that have been down for several years indicate that they are more likely to give way from the actual wearing or cutting in of the rail flange than from natural decay."

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## ENGINEERING INVENTIONS.

A retort deoxidizing machine has been patented by Mr. Israel D. Condit, Jr., of Millburn, N. J. The object is to obtain as large a heating surface and body of ore to be acted upon as can be worked, and also to secure great economy in the construction of the furnaces and in the time of deoxidation.

A dumper, for dumping coal cars, etc., has been patented by Mr. Samuel M. Keibler, of Saltsburg, Pa. It has a pivoted platform, to the bottom of which two curved bars or plates are fastened, with a weight held adjustably between, and the dumper can be readily checked or released as desired.

An improved car coupling has been patented by Mr. John C. Bryan, of Holly Springs, Ark. The object of the invention is to provide means so an ordinary pin and link coupling may be made to couple automatically, the drawhead having an internal spring so connected with a projecting lipped plate that the pin will ordinarily be held up, but the impact of the link in coupling causes it to fall.

An amalgamator has been patented by Mr. JohnMcL. Thompson, of Trumansburg, N. Y. In an amalgamating cone, with annular grooves, steam pads are provided for keeping the mercury warm; there is also a steam drum and pipes, the device being designed to keep the mercury in proper condition to operate upon the gold in cold weather, and the gold being separated from the mercury in the usual manner.

A blast furnace for zinc ores has been patented by Mr. Amedee M. G. Sebillot, of Paris, France. The object of this invention is to obtain metallic zinc direct from ores containing iron and other metals, where, heretofore, the vapors of zinc are converted into oxide by very little carbonic acid. By this furnace the carbonic acid is destroyed. There are separate condenser chambers for each outlet pipe, a chamber filled with charcoal through which vapors from the lower outlet pipe are conducted, and various novel combinations, parts, and details.

## MECHANICAL INVENTIONS.

A machine for forming eyelets has been patented by Mr. L. J. M. Mortenson, of Racine, Wis. It is a combination of mechanism by which the rod is held firmly at about its middle length, when the ends are bent upward around the former and welded together by dies.

A ratchet drill has been patented by Mr. Richard Stephens, of Negaunee, Mich. The invention covers a double acting ratchet brace, with two handles, so that almost a continuous movement can be imparted to the drill, and the same brace may be driven by either the simultaneous or alternating movement.

An oiler for loose pulleys has been patented by Mr. William D. Graves, Jr., of Presque Isle, Me. At a point in a central plane with the pulley is an oil or lubricant cup or vessel, with a screw-threaded attaching tube and wicking, the shaft having a longitudinal aperture, so the oil is, by a novel construction, supplied to the pulley at or near its center only as needed when running.

A knitting machine has been patented by Mr. Joseph M. Merrow, of Merrow, Conn. It is intended to provide that the fabric will be kept from being carried by the needles in the direction of their reciprocations. The machine is adapted to knit in both directions, and while knitting the heel of a stocking some of the needles may be raised and held up.

A water motor has been patented by Mr. Alvey C. Harvey, of Lone Pine, Cal. By admitting water in a suitable tank or cistern, a float is raised, a rack bar from which actuates a train of gearing communicating motion to a shaft, and when the water is withdrawn and the float descends suitable mechanism must intervene so the shaft shall continually rotate in one direction.

## AGRICULTURAL INVENTIONS.

A broadcast seed sower has been patented by Mr. John C. Waddell, of Union City, Tenn. There is a hopper with a rotating cross spout on the upper end of a staff connected with the gear frame, and having a foot rest to be supported in a strap carried over the shoulder of the operator, making a simple, compact, and easily working device.

A cultivator has been patented by Mr. E. B. Bellinger, of Kalamazoo, Mich. The frame has pivoted standards with curved lower parts and vertical upper ones, connected at their upper ends in pairs by rods or chains and pivoted bars, the frame being supported adjustably on wheels, so the plows may be caused to work at any desired depth in the ground, or raised above the ground if desired.

A method of and means for making mole ditches has been patented by Mr. M. H. Eaton, of Wilton Junction, Iowa. This invention covers a ditching machine of novel construction, with a plow and cutter for forming the ditch proper and the cement lining cavity, and with a feed hopper or tube for a continuous supply of cement for lining the ditch, the cement being applied as the machine moves along.

A cotton harvester has been patented by Mr. F. L. Warner, of Memphis, Tenn. When the machine is drawn over the row of cotton plants, its supporting wheels actuate a picking mechanism, in which is a belt or apron with wire teeth pickers from two to six inches long; there is a device for guiding the branches of the cotton plants between the picker belts, also strippers to take the cotton therefrom to the carrier trough.

## MISCELLANEOUS INVENTIONS.

A finger ring gauge has been patented by Mr. Frank D. McDowell, of Salem, Oregon. It is of tapering form, with lines indicating the sizes, and with intersecting longitudinal lines that mark the differences in the circumference of the different sizes.

A bill holder, for retaining bills, advertisements, and other sheets, has been patented by Mr. Peter Hand, of Glen, N. Y. There are certain novel features of construction whereby the sheets can be secured on the holder, or removed therefrom, easily and rapidly.

A drag saw has been patented by Mr. William A. Bennett, of Dallas, Texas. This machine can be built cheaplyin various sizes, may be safely worked by unskilled labor, and will save time and do good work in cross cutting timber for railway ties, cord wood, stove wood, etc.

An improved wagon seat has been patented by Mr. Seth Moore, of Salem, Ohio. The invention is a novel construction of adjustable seats for spring wagons. The seat is fastened by clamps and thumb screws to the wagon body, and the construction is light and strong.

A combined burglar alarm and telephone system has been patented by Mr. Benjamin F. Dillon, of Savannah, Ga. This invention renders possible the application of telephone wires to burglar connections, so as to effect great saving of wires and obstruction to streets in cities.

A faucet for soda fountains and other articles has been patented by Mr. Samuel M. Way, of Hempstead, N. Y. This is a special construction, involving many separate parts, but so designed that any desired substance in the fountain can be readily drawn and its amount easily regulated.

A combined potato scoop and riddle has been patented by Mr. Henry Peggs, of Windham, O. It is of novel construction, the parts being separable, and may be adapted for use with a different variety of articles, does not crush or injure the potatoes, and the leaves, dirt, etc., are separated therefrom.

An improved miner's squib or fuse, for igniting blasts, has been patented by Mr. George Hages, of Girardville, Pa. It is intended to make the match portion burn slowly until the fire reaches the inner match, and then rapidly past the choke, so there is no danger of the fire slumbering at the choke of the squib, while it will not burn rapidly until it gets there.

A scratch gauge has been patented by Mr. John E. Sherman, of North Attleborough, Mass. The marker is a many pointed circular one, and has its durablity increased by the circular construction of the gauge, different scratching points being presented at different times, and the gauge may be quickly and easily applied.

An odometer has been patented by Mr. James Gillespie, of West Point, O. The counting and recording mechanism is fixed in a hollow cylindrical case, properly attached to the axle, and the device may be geared to be readily changed to count any desired distance, striking a bell signal if wished at stated distances.

An improved metallic plastering surface has been patented by Mr. James Stanley, of New York city. The wire cloth used has corrugations or ribs, to increase its stiffness and firmness, and so that it may be fixed to the joists and studding by means of common staples, the ribs being placed transversely to the joists and studding.

An improved fire escape has been patented by Mr. Aaron Palmer, of Rochester, N. Y. It is a special arrangement of cage or frame adapted to slide down a standard, with ropes or cables and pulleys, counterbalancing weight, and spiral spring, so the cage or frame will be readily under command to move up or down, or fast or slow.

A combined table and desk has been patented by Mr. Samuel T. Corbitt, of Odessa, Mo. It is simple in construction, and can be readily adjusted for use either as table or desk, or both, the desk part being arranged to be drawn out of the table frame or pushed back into the same without disturbing articles on the table.

An improved chair has been patented by Mr. James R. Linn, of Toledo, Ohio. It provides for a seat with rockers on the bottom, and downwardly projecting lugs therefrom, the lugs passing through pockets and being surrounded by springs contained in the pockets, thus giving a very easy and comfortable motion.

An improved horse power has been patented by Messrs. Charles B. and John S. Boren, of Booneville, Miss. It has a peculiar arrangement and construction of parts such that the vertical shaft or king post is relieved of all torsional strain, and the master wheel is so elevated that a man or beast can readily pass under it.

A power jack has been patented by Mr. John W. Massey, of Gholson, Miss. It is durable, cheap, very powerful, and adapted for a great variety of uses, such as leveling buildings, laying flooring, rolling logs, etc., and it is easy and convenient to handle. One-half interest in the patent has been assigned to Mr. Madison Edwards.

A hame fastener has been patented by Mr. Marsh Noe, of Davenport, Iowa. It is automatic, and more especially intended for use in fire departments, as the fastening only requires that the ends be brought forcibly together, so the operation may be very quickly performed, and it does not require an experienced hand to manipulate it.

An improved housing for sugar and other mills has been patented by Mr. Burchard Thoens, of New Orleans, La. Its object is to lessen the cost of housing frames and facilitate construction and repairs of sugar and other mills, as well as reduce the bulk and weight of the parts and make them easy of access for removal, etc.

A wagon tongue support has been patented by Mr. A. H. Gleason, of Wabash, Ind. The design is to so hold the tongue that its weight will not be wholly carried by the team, but that it will not be so rigidly held as to produce a pounding action on the necks of the horses, and also that it may be fixed so as not to stick out in the way when not in use.

A flood gate has been patented by Mr. James A. Galloway, of Spring Hill, S. C. The design is to operate flood gates automatically, to be opened by the action of the water when it rises above a given level, for the purpose of allowing the water to escape, and the invention provides a special construction and combination of parts for this purpose.

An improved flying ball target has been patented by Mr. Frank J. Moyer, of Lockport, N. Y. A ball or half ball is provided with a flange or rim whose diameter is less than the diameter of the sphere, so the ball, when thrown from any trap or mechanical device, will rotate only on its vertical axis, and take a direct course through the air.

An improved method of forming a thumb on a continuously knitted mitten has been patented by Mr. Ila N. Moore, of Battle Creek, Mich. This is a special manner of making, requiring less work than where the thumbs are knit on, or where they are made wholly separate from the mittens, and then stitched in openings made to receive them.

A refrigerator has been patented by Mr. Charles J. Berens, of Washington, Ind., in which the valves, vents, or other openings leading to the cold air chambers from the ice may be opened and closed from the outside of the refrigerator, so the warm air may be excluded from the main part when the door or window of one of the chambers is opened.

A fire escape has been patented by Mr. George W. Watts, of Brooklyn, N. Y. It is the design of this invention to use the force of gunpowder or similar explosive for elevating ladders to the roof or windows of buildings in case of fire, by a specially devised mortar working in a swivel on a light carriage, and a peculiar construction of chain ladder.

A chain fastener has been patented by Mr. James H. Armstrong, of Pinconning, Mich. It is for drawing chains taut and holding them so, and consists of a forked lever to which a grab link is pivoted, and to this in turn a latch, so that the latch can be swung against the side of the lever and held in place in this position to draw on the chain.

A shaft press for quickly bending and setting carriage shafts; after they are steamed and softened, until dry and fixed in shape, has been patented by Mr. John C. Bach, of Hillsdale, Mich. The upper surface of a frame is curved as required by the shaft, in one plane, with studs for the lateral curves, and bearer pieces and levers for binding the shafts in position.

An improved lamp has been patented by Mr. Charles H. Bennett, of Blossburg, Pa. It is especially designed to attach to sewing machines, pantry shelves, kitchen tables, etc., so as not to be knocked down or thrown off its supporting surface, and has a novel construction of attached bracket or clamp with a spring hold, which may also be used as a handle for carrying the lamp.

A seal lock has been patented by Messrs. Jesse Jordan and A. P. Powers, of Macon, Ga. A spring bolt, pivoted in a casing in one door, has at its outer end a knife, the knife end adapted to be passed into a casing in the other door in the car body, in which latter a seal card is held, which is cut by the knife when the spring bolt is withdrawn, and the seal card drops, showing the door has been opened.

A combined boiler, fire regulator, and alarm has been patented by Mr. Charles S. Lockwood, of Newburg, N. Y. When the vessel used as a boiler on the stove, under the design of this invention, has evaporated a certain fixed or regulated amount of water, a spring then raises the boiler from the boiler hole, and the incoming air checks the fire, while an alarm connected therewith gives warning.

A fire escape has been patented by Mr. William H. Glenn, of Kirksville, Mo. It provides for a sack of perpendicular ropes, crossed by oblique ones, tied together at points of crossing, with hooks at the rim of the upper end of a projecting frame arranged to hold the sides of the sack perpendicularly, the whole forming a flexible ladder, and so there is no danger of persons falling.

An apparatus for extinguishing fires has baen patented by Mr. John K. J. Foster, of Bolton, England. The invention relates to a new method and apparatus whereby air is deprived of its oxygen and vitiated with carbonic acid and other products of combustion, by passing through or over a fire, then forcing or drawing this air deprived of power of supporting combustion through the burning structure.

A knob attachment has been patented by Mr. F. Lattimer, of Richmond, Nova Scotia, Canada. In combination with the knob and its shank is an interior bolt with an exterior screw thread and spindle receiving socket, and the extension shank has interior screw thread and a spindle receiving aperture, whereby the knob can be readily adjusted to the thickness of the door.

An improved hame tug has been patented by Mr. John J. Hipp, of Timberville, O. It is intended to obviate the draught coming upon a single point of the hame and collar, and to this end the hame tug is composed of two, three, or more straps, attached by eyes or otherwise to the hame and on their rear end to the tug buckle, so the draught will be distributed over a considerable space of the hame and collar.

A combined knife brick box and grinder has been patented by Mr. John F. Wood, of Boston, Mass. The box has a grater bottom, whereon the brick is always ready to be ground when dust is wanted for scouring knives, etc., the scouring board being arranged to slide in the box under the bottom to receive dust from the grater; the box is on rockers, so the brick may be ground by rocking the box, and thus avoid getting brick dust on the hands.

Tuttle's patent combination graduated scale is an ingenious and yet simple invention. With a scale having no finer subdivisions than eighty to the inch, it is possible to measure or lay off accurately hundredths, hundred and twentieths, hundred and fiftieths, two hundredths, two hundred and fortieths, and three hundredths of an inch. What the vernier does for angular measure this invention does more completely for linear measure. It is also equally applicable to the metric system, and thus constitutes an invention which will be valuable to engineers, draughtsmen, and surveyors, as well as to the general student.


## Insurance.

### ÆTNA INSURANCE COMPANY OF HARTFORD.

The Sixty-fourth Annual Statement of this Company, which is published on another page, presents a remarkable showing. It has the largest Cash Capital—$4,000,000—of any American fire insurance company, Assets exceeding $9,000,000, and Net Surplus of $3,269,000. It was organized in 1819, and in its 65 years of existence has paid $56,000,000 in losses. In the great Chicago fire $3,782,600, and in the Boston fire, which followed shortly after, nearly $2,000,000 in losses were promptly paid. The rigid integrity and systematic management of the Ætna have served to give it nearly three-fourths of a century of almost unprecedented and uninterrupted success, and the foundation builded upon is strong enough to guarantee continued prosperity. An inflexible rule of this company is to make all contracts plain, conclusive, and binding, and all sorts of differential disputes are carefully avoided.

## Business and Personal.

*The Charge for Insertion under this head is One Dolla a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.*

All Books on Electricity. School Electricity, N. Y.

Goodell's apparatus for blocking ice, illustrated in this issue, will be let on royalty of $100 on the first 5,000 tons or any part thereof, each year, and one cent per ton for any amount in excess of the first 5,000 tons. For particulars, address George M. Goodell, Beardstown, Ill.

Railroad and Manufacturers' Supplies. Send for 1884 prices. Greene Tweed & Co., 118 Chambers St. N. Y.

Quinn's device for stopping leaks in boiler tubes. Address S. M. Co., South Newmarket, N. H.

Nickel plating outfits $10.00 upward, full directions. E. G. Ford. Ottawa, Ill.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 86 John St. New York.

"Astronomy Made Easy," free. T., 835 Linden St., Camden, N. J.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Pumps—Hand & Power, Boiler Pumps. The Goulds Mfg. Co., Seneca Falls, N. Y., & 15 Park Place, New York.

Fox's Corrugated Boiler Furnace, illus. p. 354. Hartmann, Le Doux & Maecker, sole agents, 134 Pearl St., N. Y.

For Freight and Passenger Elevators send to L. S. Graves & Son, Rochester, N. Y.

Best Squaring Shears, Tinners', and Canners' Tools at Niagara Stamping and Tool Company, Buffalo, N. Y.

Lathes 14 in. swing, with and without back gears and screw. J. Birkenhead, Mansfield, Mass.

The Best.—The Dueber Watch Case.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent Agency, 261 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Lists 29, 30 & 31, describing 4,000 new and 2d-hand Machines, ready for distribution. State just what machines wanted. Forsaith & Co., Manchester, N. H., & N. Y. city.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

"Abbe" Bolt Forging Machines and "Palmer" Power Hammers a specialty. Forsaith & Co., Manchester, N. H.

Railway and Machine Shop Equipment.
Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, New Haven, Conn.

Water purified for all purposes, from household supplies to those of largest cities, by the improved filters manufactured by the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Blake's Belt Studs are the best fastening for Leather and Rubber Belting. Greene, Tweed & Co., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works. Drinker St., Philadelphia, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Fossil Meal Composition, the leading non-conducting covering for boilers, pipes, etc. See adv., p. 45.

Straight Line Engine Co., Syracuse, N. Y. Best in design, materials, workmanship, governing; no packing.

Drop Forgings. Billings & Spencer Co. See adv., p. 398.

Curtis Pressure Regulator and Steam Trap. See p. 14.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 14.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 14.

Lightning Screw Plates, Labor-saving. Tools, p. 12.

American Fruit Drier. Free Pamphlet. See ad., p. 29.

All Books on Electricity. School Electricity, N. Y.

Brass & Copper in sheets, wire & blanks. See ad. p. 30.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 20,000 Crank Shafts and 15,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau street, New York.

Friction Clutch Pulleys. D. Frisbie & Co., Phila., Pa.


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The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 30.

Pays well on small investment.—Stereopticons, Magic Lanterns, and Views illustrating every subject for public exhibitions. Lanterns for colleges, Sunday-schools, and home amusement. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., N. Y.

Lathes, Planers, Drills, with modern improvements. The Pratt & Whitney Co., Hartford, Conn.

Amateur Photographers can have their negatives printed or enlarged by Rockwood, No. 17 Union Square.

## Notes & Queries

### HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their indentification.

(1) J. W. K. writes: 1. I am thinking of building a very light wagon, to be run by an electric engine. Do you think it practical? A. It would be interesting as an experiment. 2. If so, how large an engine would it take to do the work? 3. Do you think one-half horse power large enough? Where can I get the engine? A. 2 and 3. One-half horse power would not do it. It would probably require a two horse power engine. 4. What would be the cost of a one horse power engine? A. $200 to $300. 5. Will you make an estimate of the cost of running a one horse engine per hour, the electricity to be generated by a battery? A. The cost would depend on the kind of battery and efficiency of its motor; but in any case it would be several times as much as steam.

(2) C. N. N. asks: Would the explosive force of steam and compressed 'air be the same, everything being equal? A. Yes; the force would be the same. It is the hot water that underlies the steam in steam boilers that is a magazine of energy and the source of the extraordinary destructiveness of exploding boilers.

(3) J. N. W. asks: 1. At what speed should small circular saws, two inches in diameter, be run for cutting brass and iron? A. For brass fifty or sixty revolutions; for iron forty, to be varied according to the size of the article cut. 2. How can I harden these saws without warping? A. Heat the saw to a good red and then place it between two masses of cold iron—the top of a cold anvil and a planed cast iron bench block are good. Unless the saw is over one-eighth of an inch thick, it will be hardened and be straight. If thicker, plunge it into water. In either case brighten it and draw to a low straw. While warm, these saws may be straightened, if warped, by judicious blows of the hammer on an anvil. 3. At what speed should iron be run in the lathe? A. Good results come from a speed of eighteen feet per minute when the iron is clean, the lathe solid, and the tool properly ground and adjusted.

(4) B. F. G. asks: 1. By what means may the human hair be dissolved and the coloring matter separated from it? A. Hair is dissolved by hydrochloric and sulphuric acids; it is also soluble in the alkalies. 2. What is the chemical composition of each of the different pigments of human hair—black, yellow, and red? A. See article on the "Color of Human Hair," p. 1464 of SCIENTIFIC AMERICAN SUPPLEMENT, No. 92.

(5) W. W. asks: 1. Will you please give receipt for varnish used by the famous Italian violin makers on their instruments? A. The following is said to produce a beautiful varnish for violins: Rectified alcohol, half gallon; add six ounces gum sandarac, three ounces gum mastic, and half pint turpentine varnish; put the above in a tin can by the stove, frequently shaking until well dissolved. Strain and keep for use. If you find it harder than you wish, thin with more turpentine varnish. 2. I have tried to make amber varnish, but I find I cannot dissolve the amber. Can you name the best mode of doing so? A. It is soluble in sulphuric acid and in pure alkalies. In making varnish, amber is generally brought into solution by heating it, then adding the oil and finally stirring in turpentine as it cools. 3. Will you also please give directions for making a practical luminous paint? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 249.

(6) P. H. M. writes: 1. I want to heat a building 40 x 25 ft. by the exhaust from engine; want to run pipe along both sides and across one end. Can I do it without too much back pressure on piston? A. Yes, have your pipe of ample size and fitted with a back pressure valve (safety valve) which you can load to such back pressure as you wish. 2. Please give rule for finding horse power of high pressure engines? A. See rule in SCIENTIFIC AMERICAN SUPPLEMENT, No. 253. 3. Where can I get a paper that treats mostly on steam engineering? A. There is no periodical published in this country specially devoted to steam engineering. For books on this subject see advertising columns.

(7) F. A. W. writes: If not asking too much would like you to give through your paper, diameters, foci, places of diaphragms, and distances apart of lens for making microscope with power of about 250 diameters. A. For your microscope you will require an object lens of one-fifth in. focus and a Huyghens eye piece of an equivalent of 2 in. focus, or what the opticians call a B eye piece. Ten in. from object glass to eye piece is the general practice, but any distance between 7 and 10 in. will be proper. The objective should be achromatic. In SCIENTIFIC AMERICAN SUPPLEMENT, No. 399, you will find an illustrated article upon eye pieces which will interest you. Also in SCIENTIFIC AMERICAN of June 17, 1882, p. 386, No. 9 Notes and Queries, you will find an illustrated description of two objectives as made for modern microscopes.

(8) G. J. S. asks: How can I find the height of hills above the sea? A. The measuring of the heights of hills and mountains from the level of the sea would be a difficult problem for you to manage, unless you were fairly versed in trigonometry and have a theodolite. The heights are sometimes obtained by means of a barometer; observation being taken at base and then at top of mountain, and the difference calculated. We recommend you to get a book on trigonometry, illustrating the methods for distances and heights.

(9) E. W. S. asks: What size ports to use in a cylinder 2 x 2½ in., as I am making model engine of that size? A. Steam ports ¼ x 1⅛ in. Exhaust, ⅛ x 1⅛ in.

(10) L. B. asks: What horse power is a boiler capable of developing, size of boiler being 10 feet long, 42 inches diameter, and 36 3-inch tubes, with a return flue; and would it be advisable to get an engine 4 or 5 horse power less than boiler, or what proportions would you have to work satisfactorily and economically? A. About 15 horse power. Yes, especially if there is a prospect of more power being required in the future.

(11) C. D. R. asks: Can I heat a room 30 x 20 ft., 9 ft. high, with steam from a 5 horse power boiler on the *same floor*, and in any way get the condensed steam back to feed boiler with? A. If your heating pipes are run above near the ceiling, and the boiler is 6 or 8 ft. lower, yes; otherwise you must trap the condensed water into a cistern or receiver and pump back to boiler.

(12) C. C. S. asks: 1. If there is any rule by which, knowing the stroke and the bore of the cylinder of an engine, you can tell its power? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 253. 2. What the relation of foot power is to horse power? We know of no direct comparison of foot power with a horse's power, but the power of 6 men is generally considered equal to 1 horse power.

(13) S. E. R. writes: We have a large cast iron rendering kettle which has a flaw and it leaks now. Will you tell us in your paper what we can do for it? Is there a cement which will stand fire?

A. Iron filings.....10 pts.
Clay.....60 "

These are worked with linseed oil into a thick paste, which is applied after some more linseed oil is added to it. It is then left to dry slowly.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. L. R.—The sample is pyrite (iron sulphide) in slate.

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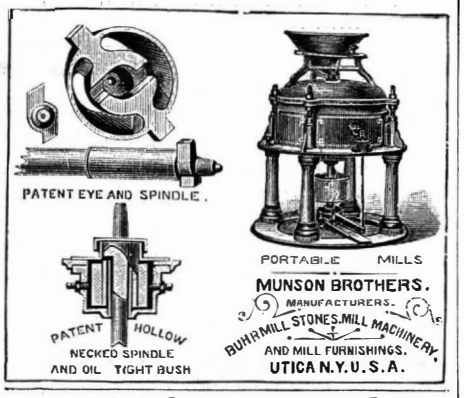


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|---|---|
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| Reserve for Re-insurance (Fire) | 1,682,252.86 |
| " " " (Inland) | 9,684.46 |
| " " " Unpaid Losses (Fire) | 166,252.75 |
| " " " (Inland) | 10,333.68 |
| All other Claims | 54,662.20 |
| NET SURPLUS | 3,269,457.85 |
| TOTAL ASSETS | $9,192,643.80 |

| *AS FOLLOWS:* | *Market Value.* |
|---|---|
| Cash in Bank | $1,031,117.34 |
| Cash in hands of Agents | 324,997.26 |
| Real Estate | 364,500.00 |
| Loans on Bond and Mortgage | 44,800.00 |
| Loans on Collaterals | 20,100.00 |
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| Accrued Interest | 1,231.98 |
| Total | $9,192,643.80 |

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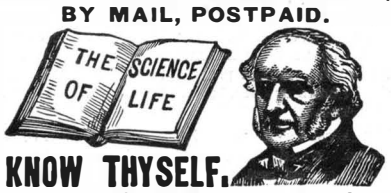


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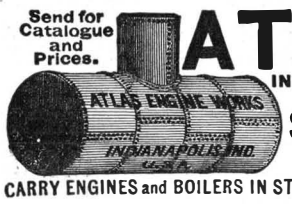


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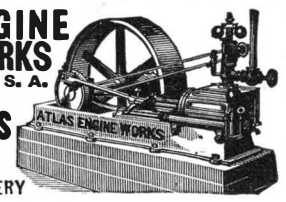


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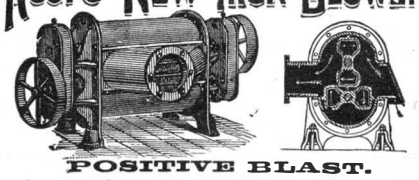

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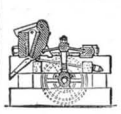

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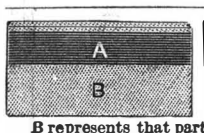


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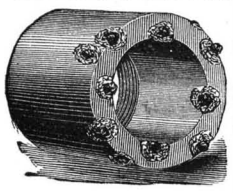

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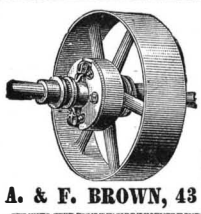

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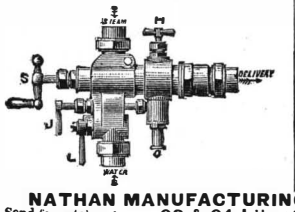

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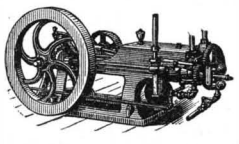

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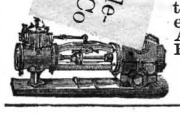

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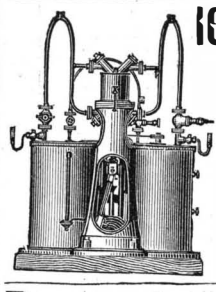

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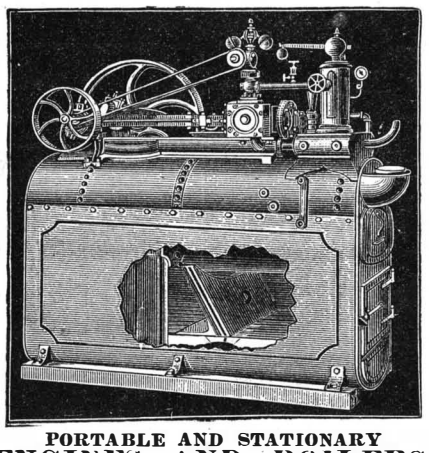

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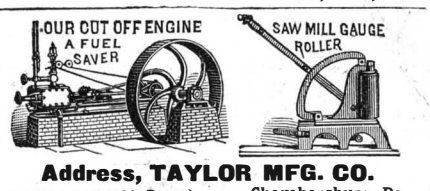


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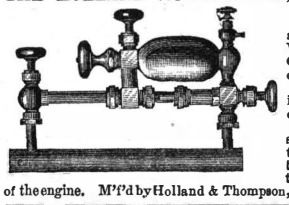

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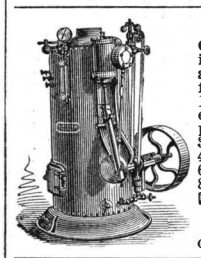

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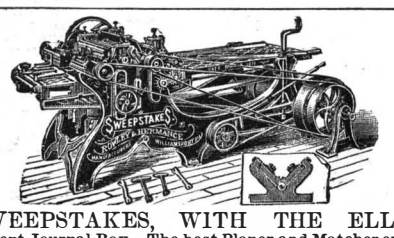


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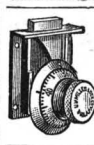

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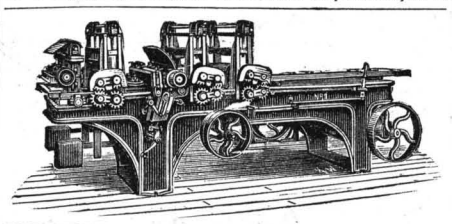

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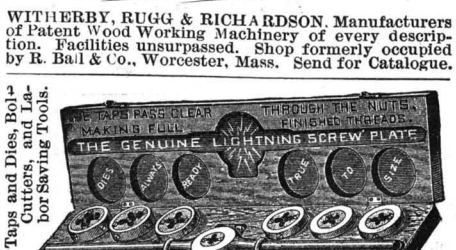


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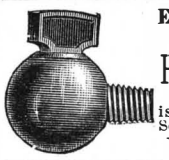

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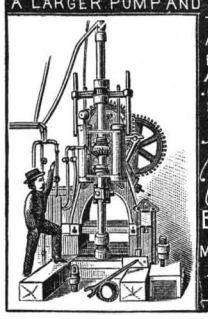

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